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RECORD, CASE No. 13,836.

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1892.

TERM No., 227.

ALBERT L. IDE, APPELLANT,

vs.

THE BALL ENGINE COMPANY, F. H. BALL, JAMES McBRIER, AND P. S. KINGSLAND.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ILLINOIS.

FILED OCTOBER 19, 1889.

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1 Pleas in the circuit court of the United States of America for the northern district of Illinois, held at the United States court-rooms, in the city of Chicago, in the district aforesaid, before the Hon. Henry W. Blodgett, judge of the district court of the United States for said northern district of Illinois, on Monday, the twenty-second day of July, in the July term of said court, in the year of our Lord one thousand eight hundred and eighty-nine, and of our Independence the one hundred and fourteenth year.

WM. H. BRADLEY, *Clerk.*

ALBERT L. IDE
vs.
BALL ENGINE COMPANY, F. H. BALL, JAMES MCBRIER, and P. S. KINGSLAND. } In Chancery.

NORTHERN DISTRICT OF ILLINOIS, *ss:*

Be it remembered that on the nineteenth day of July, 1887, came the complainant, by his solicitors, and filed in the office of the clerk of the circuit court of the United States for the northern district of Illinois, at Chicago, in said district, his bond for costs and bill of complaint in said entitled cause; which said bond and bill are respectively in the words and figures following, to wit:

2 *Bond for Costs.*

UNITED STATES OF AMERICA, *Northern District of Illinois,* } *ss:*

ALBERT L. IDE
vs.
BALL ENGINE COMPANY, F. H. BALL, JAMES MCBRIER, and P. S. KINGSLAND. } In Chancery.

I enter myself security for costs in this cause and promise to pay all costs which may accrue to the opposite party in this action or to any of the officers of this court, and, in default of payment by the complainant of any costs ordered or adjudged to be paid by him, hereby agree and stipulate that execution may issue against my property for any costs taxed against him.

Dated this nineteenth day of July, A. D. 1887.

JEROME W. MILLINGTON.

(Endorsed:) Filed July 19, A. D. 1887. Wm. H. Bradley, clerk.

3 United States Circuit Court, Northern District of Illinois.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY, F. H. BALL, JAMES MCBRIER, and P. S. KINGSLAND. } In Equity.

To the honorable the judges of the circuit court of the United States for the northern district of Illinois, in chancery sitting:

Albert L. Ide, of Springfield, in the State of Illinois, and a citizen of said State, brings this his bill of complaint against Ball Engine Company, a corporation organized and existing under and by virtue of the laws of the State of Pennsylvania and having its principal place of business at Erie, in said State of Pennsylvania, and F. H. Ball and James McBrier, of Erie, in the State of Pennsylvania, all citizens of said State of Pennsylvania, and P. S. Kingsland, of Chicago, in the State of Illinois, and a citizen of said State of Illinois.

And thereupon your orator complains and says that before the eighth day of July, eighteen hundred and eighty-four, your orator was the true, original, and first inventor of a certain new and useful improvement in steam-engine governors, not known or used by others before his said invention thereof and which had not
4 at the time of his application for a patent therefor been in public use or on sale, with his consent or allowance, for more than two years prior to his application for a patent therefor, as your orator verily believes.

And your orator further shows unto your honors that your orator, so being the inventor of said improvement and being a citizen of the United States aforesaid, made application to the proper department of the Government of the United States for letters patent therefor in accordance with the then existing laws of Congress, and, he having duly complied in all respects with the conditions and requisitions of said laws, such proceedings were had that on the eighth day of July, eighteen hundred and eighty-four, letters patent of the United States for the said improvement and invention, under the seal of the Patent Office of the United States, signed by the Secretary of the Interior and countersigned by the Commissioner of Patents, and bearing date the day and year last aforesaid, were issued in due form of law and delivered to your orator, whereby was granted and secured to him and his heirs, executors, administrators, or assigns for the term of seventeen years from the day of the date hereof the full and exclusive right of making, using, and vending to others to be used the said improvement and invention, a description whereof is given in the words of the said inventor in a schedule in writing, accompanied by drawings and references thereto, duly annexed to said letters patent when the same were issued and made a part thereof, as by the said original letters patent or a duly authenticated copy thereof, in court to be produced, will fully appear, a copy of which is hereto annexed, forming part of this bill, and marked Exhibit A.

5 And your orator further complains and says that before the

twenty-fifth day of November, eighteen hundred and eighty-four, your orator was the true, original, and first inventor of a certain new and useful improvement in steam-engine governors, not known or used by others before his said invention thereof and which had not, at the time of his application for a patent therefor, been in public use or on sale, with his consent or allowance, for more than two years prior to his application for a patent therefor, as your orator verily believes.

And your orator further shows unto your honors that your orator, so being the inventor of said improvement and being a citizen of the United States aforesaid, made application to the proper department of the Government of the United States for letters patent therefor, in accordance with the then existing laws of Congress, and, having duly complied in all respects with the conditions and requisitions of said laws, such proceedings were had that on the twenty-fifth day of November, eighteen hundred and eighty-four, letters patent of the United States for the said improvement and invention, under the seal of the Patent Office of the United States, signed by the Secretary of the Interior and countersigned by the Commissioner of patents and bearing date the day and year last aforesaid, were issued in due form of law and delivered to your orator, whereby was granted and secured to him and his heirs, executors, administrators, or assigns for the term of seventeen years from the day of the date hereof the full and exclusive right of making, using, and vending to others to be used the said improvement and invention, a description whereof is given in the words of the said inventor in a sched-
6 ule in writing, accompanied by drawings and references thereto, duly annexed to said letters patent when the same were issued and made a part thereof, as by the said original letters patent or a duly authenticated copy thereof, in court to be produced, will fully appear, a copy of which is hereto annexed, forming part of this bill, and marked Exhibit B.

And your orator further shows unto your honors that the said individual defendants herein, F. H. Ball and James McBrier, are officers and managers of said corporation defendant and have full power, knowledge, and control over, of, and concerning the acts of said corporation defendant, your orator further averring that said individual defendants directed and controlled the infringing acts complained of in this bill of complaint to the full knowledge of the same and sanctioned and endorsed said acts of infringement after the commitment thereof, as your orator is informed and believes, and, as your orator is informed and believes, said individual defendants herein jointly with said corporation defendant have jointly profited by said acts of infringement.

And your orator further shows unto your honors that the inventions and improvements described in said respective letters patent are capable of being employed, embodied, and used in each and every steam-engine governor manufactured, if so desired, and that the inventions and devices of each of the above-described letters patent are, as your orator is informed and believes, embodied in all the steam-engine governors manufactured or sold by said defend-

ants, and that in the infringement hereinafter charged and complained of the defendants manufactured and sold steam-engine governors which contained the improvements and inventions in each of said several letters patent.

7 And your orator further shows unto your honors that the said defendant corporation, the Ball Engine Company, has been since the granting of said letters patent and now is doing business within said northern district of Illinois in the sale of steam-engine governors containing the improvements and inventions described and claimed in the aforesaid letters patent belonging to your orator, said defendant corporation having a branch establishment or agency in said city of Chicago; that said steam-engine governors or many of them have been, in fact, put to such unlawful use, to the great detriment of your orator in the State of Illinois and within the jurisdiction of this court, by said corporation, the Ball Engine Company, as represented by its agent and manager at said Chicago, said agent and manager being said defendant, P. S. Kingsland, who has full knowledge of the acts of infringement herein charged and who has full control of said acts at said Chicago and within said northern district of Illinois.

And your orator further shows unto your honors that since the granting of the said letters patent aforesaid the said patentee and those acting under him have brought the said inventions into public use in various parts of the country, and that the same are of great value and have remained in the exclusive possession and use of said patentee and those holding under him to the great benefit of the public and great gains to said patentee and assignee, of which gains your orator is unjustly deprived by the acts of the defendants hereinafter mentioned.

8 And your orator further show- unto your honors that since the 25th day of November, A. D. 1884, and at divers times and occasions between that time and the time of filing this your orator's bill of complaint, the defendants herein, Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland, at Chicago, in the northern district of the State of Illinois, and elsewhere in the United States, well knowing the premises and without any legal assignment, grant, or license therefor, and in defiance of your orator's patent rights aforesaid, have made and constructed or caused to be made and constructed for use and have sold and are now making, constructing, using, and selling large numbers of steam-engine governors substantially like and upon the plan and principle and in imitation of and embracing in each of said steam-engine governors either the whole or one or more of the said inventions and improvements contained in said letters patent, and the said defendants persist in so doing and refuse to desist, although warned and requested so to do, whereby great injury has resulted to your orator and great gains and profits to a large sum of money have accrued to the said defendants from the use of your orator's exclusive rights, the full amount of which is unknown to your orator, but which in equity belong to your orator and should be accounted for by the said defendants as damages to your orator and paid over to

your orator as the avails of his exclusive rights aforesaid, and profits and gains which your orator would have derived from his said patent rights but for the unlawful acts of the said defendants.

To the end, therefore, that the said defendants may, if they can, show why your orator should not have the relief herein prayed and may, without oath (an answer on oath being hereby expressly waived) and according to the best and utmost of their knowledge, remembrance, information, and belief, full, true, direct, and
9 perfect answer make to all and singular the premises, and that they may be decreed to account for and pay over to your orator all gains and profits realized by them and also the damages suffered by your orator from the unlawful making, using, or vending the improvements vested in your orator as aforesaid and may be perpetually restrained by an injunction to be issued out of this honorable court from making, using, or vending any steam-engine governors containing the improvements and inventions secured as aforesaid to your orator or any material part thereof, and that your orator may have such other or further relief as equity may require and to your honors may seem meet—

May it please your honors to grant unto your orator the writ of injunction conformable to the prayer of this bill until the further order of this court, and also a writ of subpœna directed to the said defendants, Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland, and commanding them at a certain time and under a certain penalty to appear before your honors in this court, then and there to answer unto this bill of complaint and to abide by and perform such decree as the court shall make in the premises; and your orator will ever pray, etc.

ALBERT L. IDE.

OFFIELD & TOWLE,
Solicitors and of Counsel for Complainant.

10 UNITED STATES OF AMERICA, }
Northern District of Illinois, } ss:

Albert L. Ide, being duly sworn, deposes and says that he has heard the foregoing bill read and knows the contents thereof, and that the same is true of his own knowledge except as to the matters which are therein stated on information and belief, and as to those matters he believes the same to be true; and said deponent further says that he does verily believe that he is the original and first inventor of the things patented to him as in said bill stated.

ALBERT L. IDE.

Subscribed and sworn to this 19th day of July, A. D. 1887, before me—

FREDERICK C. GOODWIN,
[SEAL.] *Notary Public.*

See exhibits with testimony.

(Endorsed:) Filed July 19, 1887. Wm. H. Bradley, clerk.

11 On the same day, to wit, on the nineteenth day of July, 1887, there issued out of said clerk's office a writ of subpœna in said entitled cause; which said writ, together with the return of the marshal endorsed thereon, is in the words and figures following, to wit:

Subpœna.

UNITED STATES OF AMERICA, } ss:
Northern District of Illinois, }

The United States of America to Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland, Greeting:

We command you and every of you that you appear before our judges of our circuit court of the United States of America for the northern district of Illinois, at Chicago, in said district, on the first Monday in the month of September next, to answer the bill of complaint of Albert L. Ide, this day filed in the clerk's office of said court, in said city of Chicago, then and there to receive and abide by such judgment and decree as shall then or thereafter be made, upon pain of judgment being pronounced against you by default.

To the marshal of the northern district of Illinois to execute.

Witness the Hon. Morrison R. Waite, Chief Justice of
[SEAL.] the Supreme Court of the United States of America, at Chicago aforesaid, this 19th day of July, in the year of our
12 Lord one thousand eight hundred and eighty-seven and of our Independence the 112th year.

WM. H. BRADLEY, *Clerk.*

Memorandum.

The above-named defendants are notified that unless they and each of them shall enter their appearance in the clerk's office of said court, at Chicago aforesaid, on or before the day to which the above writ is returnable, the complainant's bill will be taken against them as confessed and a decree entered accordingly.

WM. H. BRADLEY, *Clerk.*

Marshal's Return.

I have served the within writ within my district in the following manner, to wit: Upon Ball Engine Company, therein named, on the 19th day of July, A. D. 1887, by delivering a true copy thereof to P. S. Kingsland, as agent of the aforesaid company, on that day.

I did not serve the president of the aforesaid company nor the other defendants, having been unable to find either them or that they had any residence within my district. I did not serve P. S. Kingsland individually, by direction of pl'ff's attorney.

F. H. MARSH,
U. S. Marshal,
By GEO. N. JONES, *Deputy.*

(Endorsed:) Filed July 19, A. D. 1887. Wm. H. Bradley, clerk.

13 Afterward, to wit, on the third day of October, 1887, came The Ball Engine Co., James McBrier, Frank H. Ball, and P. S. Kingsland, by their solicitors, and filed in said clerk's office their answer to the bill in said entitled cause; which said answer is in the words and figures following, to wit:

14 United States Circuit Court, Northern District of Illinois.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.* } In Equity.

The joint and several answer of The Ball Engine Co., James McBrier, Frank H. Ball, and P. S. Kingsland, defendants, to the bill of complaint of Albert L. Ide, complainant.

These defendants, now and at all times hereafter saving and reserving unto themselves all and all manner of benefits and advantage of exception that can or may be taken or had to any errors, uncertainties, or insufficiencies in said bill of complaint, for answer thereto or unto so much thereof as they are advised it is material for them to make answer unto, answering, say:

First. This defendant, The Ball Engine Co., answering, says that it is a corporation under the laws of the State of Pennsylvania and is resident at Erie, in the county of Erie, in said State of Pennsylvania, and is engaged in the business of manufacturing and selling steam-engines and steam-engine governors.

Second. This defendant, James McBrier, answering, says that he is the president of said corporation, the Ball Engine Company, and that he is in no way engaged in the manufacture of steam-engines or steam-engine governors except as a member and officer of the said Ball Engine Company, and that he is a resident of the city of Erie, State of Pennsylvania.

Third. And this defendant, Frank H. Ball, answering, says that he is the treasurer of said corporation, the Ball Engine Co.,
15 and that he is in no way engaged in the manufacture of steam-engines or steam-engine governors except as a member and officer of said Ball Engine Co., and that he is a resident of the city of Erie, State of Pennsylvania.

Fourth. And this defendant, P. S. Kingsland, answering, says that he is engaged in the business of selling machinery, steam-engine boilers, etc., in the city of Chicago, State of Illinois, and that in pursuance of said business he has sold steam-engines and steam-engine governors made by the said Ball Engine Co., and in that particular he has acted as the agent of the said Ball Engine Co., but further than as above stated he has no interest in the said Ball Engine Co.

Fifth. That these defendants, jointly and severally answering, say that they deny that A. L. Ide, the said complainant, before the 8th day of July, 1884, was the true, original, and first inventor of any improvements in steam-engine governors not known or used by

others before his alleged invention thereof and which at the time of his application for a patent therefor had not been in public use and on sale for more than two years, as set up in his bill of complaint.

Sixth. These defendants, further answering, say that they are informed and believe it to be true that letters patent of the United States were granted to the complainant, A. L. Ide, on the 8th day of July, 1884, and No. 301,720, for an alleged improvement in steam-engine governors, but whether or not the said letters patent were applied for or issued with the formalities set forth in said bill of complaint and whether or not the said A. L. Ide was or continues to be the sole and exclusive owner of said letters patent these defendants do not know and are not informed save by said bill,
16 and leave the said complainant to make such proof thereof as he may be advised is material; but these defendants deny that said complainant, A. L. Ide, has the sole and exclusive right and privilege of making, using, and selling engine governors made according to the alleged invention set forth in said letters patent No. 301,720.

Seventh. And these defendants, further answering, say on information and belief that the invention described in said letters patent No. 301,720 was, prior to the alleged invention thereof by the said A. L. Ide, well known to and practiced by the following persons, to wit:

Horace Tabor, at Hartford, Conn., who now resides in the city of New York.

A. E. Leavit, at Hartford, Conn., who now resides at Vernon, in the State of Indiana.

J. W. Thompson, at Salem, Ohio, who now resides at Salem aforesaid.

Nathan Dawley, at Lawrence, Mass., who now resides at Lawrence aforesaid.

E. H. Schneider, at Syracuse, New York, and Brooklyn, New York, *now who* resides at Brooklyn aforesaid.

James Smith, at Syracuse, N. Y., who now resides at Syracuse aforesaid.

Ira M. Geer, at Syracuse, N. Y., who now resides at said Syracuse.

Joseph S. Millet, Brooklyn, N. Y., who now resides in said Brooklyn.

J. W. Hussey, Brooklyn, N. Y., who resides at No. 289 Putnam Ave., Brooklyn, N. Y.

L. A. Upson, at Enfield, Conn., who now resides at said Enfield.

William Steel, who resides at Enfield, Conn., at said Enfield.

17 These defendants further say that engine governors were made at the works of the Hartford Engineering Co., at Hartford, Conn., prior to the alleged invention of A. L. Ide, having thereon the same invention as is described in said letters patent No. 301,720; also at the works of the Buckeye Engine Co., at Salem, Ohio, but these defendants are now unable to give the names further than as above of the persons who worked upon said governors or knew of their construction or who used the same or knew of their

use, but pray to be allowed to make such proof thereof as they shall be able to do.

These defendants further say that said engine governors made by said Buckeye Engine Co. and the said Hartford Engineering Co. were used publicly before the alleged invention of the said A. L. Ide in the following places, to wit:

One engine governor at the Syracuse iron works, at Syracuse, N. Y.

Two engine governors at the Hartford Carpet Co., at Enfield, Conn.

Two engine governors at Dows Store, Brooklyn, N. Y.

One engine governor at the works of White, Potter & Page Manufacturing Co., at Brooklyn, N. Y.

Two engine governors at the Pacific mills, in Lawrence, Mass.

But these defendants are unable to give the names of persons further than as above who worked upon or had charge of or knew of the use of said engine governors, but pray that they may be permitted to make such other and further proof of said uses as they may be able to do.

Eighth. And these defendants, further answering, say that
18 the invention described and claimed in the said letters patent No. 301,720 was described in a printed publication prior to the alleged invention thereof by the said complainants, to wit:

In "A Manual of Machinery and Mill Work, by W. J. M. Rankin, third edition, printed by Chas. Griffin & Co., London, 1880," on page 418, section 364, and in former editions of said work, one of which is dated as far back as 1859, as these defendants are informed and believe to be true, and pray to be allowed to make proof thereof in such manner as the court shall direct.

Ninth. And these defendants, further answering, say that in view of the state of the art as it existed at the date of the alleged invention set forth in said letters patent 301,720 it required no more than the exercise of ordinary mechanical skill and not the exercise of invention to devise and construct the device shown and described in said letters patent, and that therefore the said letters patent are void and of no effect in law.

Tenth. And these defendants, further answering, say that they deny that A. L. Ide, the complainant, was, before the 25th day of November, 1884, the true, original, and first inventor of any improvement in steam-engine governors described in letters patent 308,498.

Eleventh. And these defendants, further answering, say that they are informed and believe it to be true that letters patent of the United States No. 308,498 were issued to the said complainant on the 25th day of November, 1884, for an alleged improvement in steam-engine governors, but whether or not the said letters patent were applied for and issued with the formalities set forth in said bill of complaint and whether or not the said Ide was or continues to be the
19 sole owner of said letters patent these defendants do not know and are not informed save by said bill of complaint and leave said complainant to make such proof thereof as he may be advised

is material; but these defendants deny that said A. L. Ide has the sole and exclusive right and privilege of making, using, and selling engine governors made according to the alleged invention described in said letters patent No. 308,498.

Twelfth. And these defendants, further answering, say on information and belief that the invention set forth in said letters patent No. 308,498 was, prior to the alleged invention thereof by said complainant, well known to and practiced by A. E. Leavitt at a place not now known by these defendants and by others associated with said Leavitt, whose names are not now known by these defendants, said Leavitt being now a resident of Vernon, Indiana.

Thirteenth. And these defendants, further answering, say that they believe it to be true that the invention described in the said letters patent Nos. 301,720 and 308,498 may be employed, embodied, and used in steam-engine governors conjointly, but these defendants deny that either or both of said inventions have ever been employed or used in any steam-engine governor ever made, used, or sold by them or either of them.

Fourteenth. And these defendants, further answering, say that they do not know and are not informed, except by said bill of complaint, whether or not the said inventions have been practiced by the complainant, to his great profit or gain, but they deny that they have practiced said inventions or deprived the complainant of any of his just profits or gains by reason of practicing said inventions or either of them.

Fifteenth. And these defendants, further answering, say that the said Ball Engine Co. and the said Ball and McBrier, as members and officers of said company, and the said Kingsland, as the salesman of engines made by the said Ball Engine Co., are engaged in the manufacture and sale of steam-engines known as the Ball engine, on which are employed steam-engine governors which are made in accordance with certain several letters patent issued to the said Ball, but they deny that said engine governors embody or contain in their construction either of the inventions described and claimed in letters patent named in said bill of complaint, and that therefore they have not infringed upon any of the patent rights of the complainant or in any way deprived him of any just or lawful right secured to him by said patents, and that therefore they should not account to this honorable court for any of the gains or profits they may have made in their said occupations.

Sixteenth. And these defendants, further answering, say that the said letters patent named in said bill of complaint are void and of no effect in law because of inventions therein describeed having been known and practiced by others, as hereinbefore stated, long prior to the invention thereof by complainant, and by reason of the fact that, in view of the state of the art as it existed at the time of the alleged inventions of complainant, as will be duly shown by the defendants' proofs, it required no exercise of the inventive faculty to construct the devices shown and described in the letters patent named in the said bill of complaint.

21 Seventeenth. And these defendants, further answering, say that, in view of the state of the art as it existed at the date of the alleged inventions by complainant, the claims of the said letters patent named in the bill of complaint must, if they are sustained, be so limited in their construction as not to include in their scope the construction made by the Ball Engine Company.

Eighteenth. And these defendants, further answering, deny all and all manner of conspiracy, wrong, injustice, illegal or inequitable conduct wherewith they are charged in and by said bill of complaint, and without this, that there is any other matter, cause, or thing in said bill of complaint contained material or necessary to make answer unto and not herein and hereby well and sufficiently answered, confessed, avoided, traversed, or denied is true to the best knowledge and belief of these defendants; and these defendants pray the same benefit of the facts and things herein set forth as if for the reason thereof the said bill had been demurred to when a demurrer would have been proper and the same benefit thereof as if they had especially pleaded to said bill where a special plea would have been proper.

And these defendants submit to this honorable court that said complainant is not entitled to any further answer to said bill or any part thereof than is hereinbefore contained and no right to any injunction, account, or other relief prayed for in said bill; and these defendants pray to be hence dismissed with their reasonable costs and charges in this behalf most wrongfully sustained.

(Signed) JNO. K. HALLOCK,
J. H. RAYMOND,
Defendants' Solicitors.

It is stipulated and agreed that the within answer may be filed *nunc pro tunc* as of October 3rd, 1887.

Chicago, 4th Oct., 1887.

OFFIELD & TOWLE,
Sol's for Compl't.
J. H. RAYMOND,
Sol'r for Def'ts.

(Endorsed:) Filed Oct. 3, 1887. Wm. H. Bradley, clerk.

22 Afterward, to wit, on the sixth day of December, 1887, came the complainant, by his solicitors, and filed in said clerk's office his replication to the answer of the defendants in said entitled cause; which said replication is in the words and figures following, to wit:

Replication.

United States Circuit Court, Northern District of Illinois.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY, F. H. BALL, JAMES McBRIER, and P. S. KINGSLAND. } In Chancery.

The replication of Albert L. Ide, complainant, to the answer of Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland, defendants.

This repliant, saving and reserving unto himself now and at all times hereafter all and all manner of benefit and advantage of exception which may be had or taken to the manifold insufficiencies of the said answer, for replication thereunto says that he will aver, maintain, and prove his said bill of complaint to be true, certain, and sufficient in law to be answered unto, and that the said answer of the said defendants is uncertain, untrue, and insufficient to be replied unto by this repliant; without this, that any other
23 matter or thing whatsoever in the said answer contained material or effectual in the law to be replied unto and not herein and hereby well and sufficiently replied unto, confessed or avoided, traversed or denied, is true; all which matters and things this repliant is and will be ready to aver, maintain, and prove as this honorable court shall direct, and humbly prays as in and by his said bill he has already prayed.

OFFIELD & TOWLE,
Sol'rs for Compl't.

(Endorsed:) Filed Dec. 6, 1887. Wm. H. Bradley, clerk.

24 Afterward, to wit, on the twelfth day of December, in the adjourned October term of said court, 1887, in the record of the proceedings thereof in said entitled cause, before Hon. Henry W. Blodgett, district judge, is the following entry, to wit:

Order.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.* } In Chancery.

Now come the parties, by their solicitors, and, on motion of J. H. Raymond, Esq., complainant is ruled to close his *prima facie* proof by January 20 next and defendants are ruled to close their evidence within forty days thereafter.

25 Afterward, to wit, on the ninth day of April, in the adjourned March term of said court, 1889, in the record of the

proceedings thereof in said entitled cause, before Hon. Henry W. Blodgett, district judge, is the following entry, to wit:

Order.

ALBERT L. IDE
vs.
THE BALL ENGINE COMPANY *et al.* } In Chancery.

Now come the parties, by their solicitors, and this cause, being set for hearing this day, comes on to be heard upon pleadings and proofs, and, after hearing the arguments of counsel, the court takes the same under advisement.

26 Afterward, to wit, on the twenty-second day of July, 1889, there was filed in said clerk's office the opinion of Judge Blodgett in said entitled cause; which said opinion is in the words and figures following, to wit:

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.*

JULY 22, 1889.

BLODGETT, *J.:*

This is a bill in equity for an injunction and accounting by reason of the alleged infringement by defendant- of letters patent No. 301,720, granted July 8, 1884, to the complainant for a "steam-engine governor."

The nature and scope of the invention covered by this patent is described by the patentee in his specifications as follows:

"This invention relates to that class of steam-engine governors known as 'fly-wheel governors,' and has for its primary object to provide means for holding the eccentric steadily in its proper poised position in opposition to the tendency of certain extraneous forces which are calculated to disturb the movements of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion.

"To this end the invention consists in the combination of a dash pot with the governor and pulley, said dash pot connected with a fixed and a movable part or with two relatively or unequally movable parts, as, for example, with the extremity of a weight lever and the pulley hub.

27 "In this class of governors the position of the eccentric is variably determined by the opposing and self-balancing forces exerted by the centripetally acting spring or springs and the centrifugally acting weight or weights connected with said springs, the intention being to hold the eccentric permanently in a certain poised position for a given speed of the wheel to which the governor is applied and to vary the position of the eccentric exactly as the speed of said wheel is varied. There are, however, certain temporarily

acting causes of disturbance calculated to change the position of the eccentric independently of the speed of the wheel. The principal of these disturbing causes is the inertia of the reciprocating parts, including the eccentric and the parts actuated thereby, and a secondary cause is the gravity of the eccentric when not counterbalanced by some special device for the purpose. At a regular and very high speed of the governor wheel or pulley these disturbing forces operate but slightly, owing to the momentum of the weights, which serve to prevent their deflection from a regular course, but at lower speeds than that at which the apparatus is adjusted to run and particularly in accelerating or retarding the engine, as in starting up or slowing down, these incidental disturbing forces interfere materially with the valve action and give an objectionable irregularity to the movements of the weights. In the case of an engine used for running a dynamo for electric-lighting purposes and subject to sudden and wide changes in requisitions of power and speed the effects of the disturbances referred to manifest themselves also in the quality or intensity of the lights. A dash pot constructed and attached to the apparatus in such a manner as to pre-
28 vent sudden movements of the weight levers or of the eccentric is found in practice to wholly overcome the defects indicated and to give a desirable steadiness and regularity to the movements of the movable parts of the governor as well as accuracy and reliability to the cut-off action of the valve. * * *

"The cylinder of the dash pot is filled with glycerine or some other non-compressible liquid, preferably one that is also not congealable at a temperature to which the engine is likely to be exposed. By means of the dash pot applied to the relatively movable and stationary or to the unequally moving parts as described wide and sudden radial movements of the weights E are prevented, and as a consequence the governor will have a steady and efficient action at all speeds of the pulley or wheel to which said governor is applied. * * *

"By the term 'dash pot' in the appended claim I mean the device technically known by that name, usually comprising a close cylinder, a piston having a passage through or around it, and a fluid confined in the cylinder as shown or its equivalent."

The patentee has but one claim, which is:

"In a fly-wheel governor, the combination with relatively movable parts of a dash pot, substantially as described."

The proof shows without dispute that as early as 1880 the Buckeye Manufacturing Company of Salem, Ohio, placed upon the driving shaft of their engines governors with weighted arms arranged to swing centrifugally as the shaft revolved, so as to act upon the eccentric, and kept from swinging too readily by centripetal
29 springs, the arrangement and function of the movable and fixed parts of the governor being substantially like the movable and fixed parts of the Ide governor except that it had no dash pot, the operative parts being held in place upon the shaft of the engine within a comparatively light shell or case with radial arms extending from the shaft. One of these Buckeye engines was placed

in what was known as the Pacific elevator or Dow's stores, in Brooklyn, in the State of New York, and, its governor not securing such steadiness of motion in the engine as was desired, a dash pot was in December, 1880, put into the governor in substantially the manner shown by the Defendant's Exhibit "B" in evidence in this case, the dash pot in Exhibit B being attached to one of the swinging arms of the governor and to a fixed part, so that its operation was essentially the same as that of the dash pot in the complainant's patent.

In July, 1881, governors similar in arrangement of parts and with dash pots were put into the engines of the Hartford Carpet Company, at Thompsonville, Connecticut, and the engine of the Hartford Manilla Company, at Burnside, Connecticut, and these governors with dash pots attached had continued in use on these engines up to the time the proofs were taken in this case, and all had proved effective in securing steadiness of action in the engines to which they were attached, or, as the witnesses expressed it, preventing sudden and violent fluctuations of the governor.

The dash pots attached to these Buckeye governors were connected with a movable and fixed part of the governor in such a manner as to be accurately described by the specifications of
30 complainant's patent. In other words, the structure of these Buckeye governors with the dash pot added was such as to make them a manifest and palpable infringement of the complainant's patent if they had been made and used after instead of before that patent.

The only feature in which these Buckeye governors with the dash pot added can be differentiated from the complainant's patent is that they were not placed in the fly-wheel of the engines to which they were attached. Mr. Ide has taken this Brooklyn and Thompsonville governor out of the shell or disk in which it was placed by the agents of the Buckeye Company on the shaft and attached it to the hub and radial arms of the fly-wheel of his engine, and the claim of his patent is for putting this governor with dash pot into the fly-wheel of the engine.

The most he has done has been to fasten this old Brooklyn and Thompsonville governor to the arms of the fly or balance wheel of his engine instead of leaving it on the driving shaft where he found it, and the only question is, has he invented anything in doing this? I do not learn from the proof that any new function is obtained by the combination covered by this claim; the governor still performs the same function and no other that it did when fastened to the shaft by the shell and arms as in the Brooklyn and Thompsonville governors, and the fly-wheel still performs the functions it did before the governor was brought into it; their joint operation when combined is the sum, and only that of their separate operation in the older machines.

31 The patent, therefore, seems to me to come clearly within the rule in Ruckendorfer *vs.* Faber, 92 U. S., 354, and Pickering *vs.* McCullough, 104 U. S., 310. It is true there may be some convenience in bringing these parts together and making a more

compact machine, but that is a mere mechanical change which does not rise into the realm of invention. As was said by Mr. Justice Matthews in the case last cited, "In the patentable combinations of old elements all the constituents must so enter into it as that each qualifies every other. * * * It must form either a new machine of a distinct character and function or produce a result due to the joint co-operating action of all the elements. It is not a mere adding together of separate contributions."

For these reasons I am of opinion that the patent is not valid and that the bill should be dismissed for want of equity.

(Endorsed:) Filed July 22, 1889. Wm. H. Bradley, clerk.

32 On the same day, to wit, on the twenty-second day of July, in the July term of said court, 1889, in the record of the proceedings thereof in said entitled cause, before Hon. Henry W. Blodgett, district judge, is the following entry, to wit:

Decree.

ALBERT L. IDE
v.
BALL ENGINE COMPANY *et al.* } In Chancery.

The court, having considered the matters submitted on the hearing herein, finds the equities with the defendants, and thereupon it is ordered that the complainant's bill be dismissed for want of equity at complainant's costs, and that execution issue therefor.

The complainant, by his solicitor, prays an appeal to the Supreme Court of the United States from this order of dismissal, which is allowed on complainant's filing an appeal bond in the penal sum of one thousand dollars within sixty days, with surety to be approved by the court.

33 Afterward, to wit, on the twelfth day of August, 1889, there was filed in said clerk's office an appeal bond in said entitled cause; which said appeal bond is in the words and figures following, to wit:

Appeal Bond.

Know all men by these presents that we, Albert L. Ide, of Springfield, Illinois, and John A. Roche, of Chicago, Illinois, are held and firmly bound unto Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland in the full and just sum of one thousand dollars to be paid to the said Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland, their certain attorney, executors, administrators, or assigns; to which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, jointly and severally, by these presents.

Sealed with our seals and dated this — day of August, in the year of our Lord one thousand eight hundred and eighty-nine.

Whereas lately, at a regular term of the United States circuit court for the northern district of Illinois, in a suit depending in said court between Albert L. Ide, complainant, and Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland, defendants, a decree was rendered against the said Albert L. Ide, and the said
34 Albert L. Ide having prayed an appeal to the Supreme Court of the United States to reverse said decree:

Now, the condition of the above obligation is such that if the said Albert L. Ide shall prosecute his appeal to effect and answer all damages and costs if he fail to make his plea good, then the above obligation to be void; else to remain in full force and virtue.

ALBERT L. IDE. [SEAL.]
JOHN A. ROCHE. [SEAL.]

Approved by—
H. W. BLODGETT, *Judge.*

(Endorsed:) Filed Aug. 12th, 1889. Wm. H. Bradley, clerk.

35 United States Circuit Court, Northern District of Illinois.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.* } In Equity.

At Chicago, in the northern district of Illinois, on this 16th day of January, A. D. 1888, at 10 o'clock a. m., before me, Frederick C. Goodwin, a notary public within and for Cook county, Illinois, residing at the city of Chicago, in said district, at the office of Offield and Towle, room 99, 185 Dearborn St., Chicago, Illinois.

Present: H. S. Towle, Esq., on the part of complainant, and J. H. Hallock, Esq., on the part of defendants.

And thereupon the following proceedings were had before me pursuant to notice hereto attached:

It is stipulated by and between the respective counsel in the above-entitled cause that printed copies of letters patent when furnished by the United States Patent Office may be used by either party with the same force and effect as if duly certified.

Counsel for complainant offers in evidence letters patent to Albert L. Ide, No. 301,729, dated July 8, 1884, and requests the notary before whom this deposition is being taken to identify the same with this cause and to mark the same "Complainant's Exhibit Complainant's Patent."

Counsel for complainant further offers in evidence the model of a fly-wheel governor, now produced, and requests the notary before whom this deposition is being taken to identify said model with this record and to mark the same "Complainant's Exhibit Defendants' Fly-wheel Governor."

It is here stipulated and agreed on the part of defendants'
36 counsel that between the date of the issuing of said letters patent No. 301,729, of date of July 8, 1884, and the date of the filing of the bill of complaint herein the defendants manufactured

fly-wheel governors like "Complainant's Exhibit Defendants' Fly-wheel Governor," and embodied the same as a part of their engine constructions and used the same between the dates aforesaid within the northern district of Illinois.

And thereupon complainant's counsel calls Mr. M. E. DAYTON as a witness in his behalf, who, being by me duly sworn to testify the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by Mr. H. S. TOWLE:

Q. 1. Please state your name, age, residence, and occupation.

A. Name, Melville E. Dayton; age, 51 years; residence, Chicago; occupation, mechanical expert and solicitor of patents.

Q. 2. Please state generally what experience and education you have had which qualifies you to compare mechanisms in various arts and industries and by such comparisons to understand and point out the similarities and differences between such mechanisms. State briefly what experience you have had as an expert witness in connection with mechanical devices, patented or otherwise.

A. I was reared among machinery, and having a natural fondness for such matters I became early familiar with the construction and operation of many kinds of machines and skilled in the use of mechanical tools. I learned the machinists' trade in youth and made a thorough study of theoretic mechanics. Besides
37 having maintained my interest in such matters through life I have for the past 16 years been engaged in soliciting patents, and for the past 12 or 13 years have acted many times each year as an expert witness concerning mechanical matters in patent suits. In my experience as solicitor of patents and expert it has been my daily and constant practice to analyze mechanisms and to compare mechanical devices with each other and with the descriptions and claims of letters patent.

Q. 3. Please state whether or not you have carefully examined so that you fully understand the same, as well as the construction and operation of the mechanism therein described and shown, the letters patent appearing in this cause, and marked "Complainant's Exhibit Complainant's Patent."

A. I have.

Q. 4. Please state briefly what you understand to be the invention set forth in said patent as identified and expressed in the single claim thereof.

A. The single claim of the patent reads as follows:

"In a fly-wheel governor, the combination, with relatively movable parts, of a dash pot, substantially as described."

The drawings and description of the patent set forth the fly-wheel of a steam-engine provided with levers E, pivoted to the arm *a* of the fly-wheel, and carrying weights E' at a distance from the pivotal points *e*. These weights, in the rotation of the fly-wheel, have a tendency to move outwards under the action of centrifugal force. Such centrifugal movement is opposed by springs F, attached at

their opposite ends respectively to the weight levers E and
38 to the fly-wheel. In the operation of a governor of this general class, a change in speed of the fly-wheel will be accompanied by a change in the radial position of the weights E′, said weights moving outward with an increase in speed and inward with a diminution of speed of the fly-wheel. These movements of the weights are made use of to control or vary the admission of steam to the engine cylinder, so that when, with a lessening of the load, for example, the engine would acquire a greater speed or, on the other hand, with an increase of the load, its speed would be lessened, the amount of steam may be lessened or increased, with the result of preserving a substantially uniform speed of the engine under these varying conditions. This control of the steam supply by movement of the governor weights is effected through the medium of an eccentric, movably mounted on the shaft of the fly-wheel, and connecting rods leading from the weights or the weight levers directly or indirectly to said eccentric. The eccentric is connected with the steam valve of the engine and, as the eccentric is shifted by movement of the weights, the valve is shifted in its position relative to the engine piston so as to vary the induction of steam behind said piston.

Varying steam pressure in the boiler as having a tendency to change the speed of the engine is also met by this action of the governor weights to shift the position of the valve with the purpose of insuring uniformity of speed of the engine.

Such a governor as is above described, when adjusted to a practical equilibrity of centrifugal and centripetal forces (respectively of the weights and the springs), while promising theoretically or upon
a superficial inspection to work more perfectly than when
39 these forces are adjusted out of perfect balance or equilibrity, is found in fact and for a reason to be actually unstable and irregular in its movements. In other words, when the governor is adjusted to actual equilibrity a change in steam pressure or in work being done by the engine results in an excessive throw of the governor balls to and from their extremes of movement with the result of correspondingly shifting the valve through the medium of the eccentric as described. To avoid this improper action of the governor it has been the custom to give to the centripetal springs a less tension than would exactly balance the centrifugal force of the governor balls in their inner positions, and this, of course, detracts from the sensitiveness of the governor.

The invention of the Ide patent assumes extreme sensitiveness or substantially perfect equilibrity between the centrifugal and centripetal forces and by the application of a dash pot to the relatively movable parts of the governor prevents the extreme movements of the governor balls and consequently of the valve while retaining such sensitiveness of the governor.

The dash pot described and claimed in this combination in the Ide patent is a cylinder to which is fitted a movable piston and which is filled with oil, glycerine, or other non-compressible liquid. The body of the dash pot is attached, say, to an arm of the fly-

wheel and the piston of the dash pot is connected by a rod with one of the weight levers. This piston rod passes through a stuffing box in the cap of the dash-pot cylinder and the piston itself is provided with a hole through it, through which hole the liquid may pass from one side of the piston to the other in the forced move-
40 ments of said piston, as produced by the movement of the governor weight to which the piston rod is connected. There will be a resistance to the passage of the liquid from one side to the other of the piston through the hole in the latter, which resistance will be proportioned to the size of said hole. The hole being of proper size, the piston of the dash pot will allow the governor weight to move with all necessary promptness for nice governor regulation, while at the same time the dash pot will prevent the governor weights from rushing to their extreme positions and back again, as was the fact when the governor was made equilibrious and the dash pot was not used. The result, therefore, of the use of the dash pot, as set forth in the Ide patent, is, primarily, to give steadiness to an equilibrious governor and consequently to the valve. The final result is therefore to ensure quick response of the governor to changes of steam pressure and load and practical uniformity of speed under such changes of load and pressure.

The Ide patent further points out that there are certain extraneous forces which are calculated to disturb the regularity of a sensitive or equilibrious governor, namely, the momentum of certain movable parts and the gravity of others. Not only does his dash pot enable him to make his governor equilibrious and therefore sensitive, but it also prevents the disturbance of such a sensitive governor by these extraneous forces.

The invention consists, for any or all the purposes which it is adapted to accomplish, in the combination stated in the claim already quoted.

The dash pot is shown in the patent attached to a bar which has slight movement with respect to the fly-wheel, but less move-
41 ment than the point of the weight lever to which the piston rod of the dash pot is attached. The patent points out that it is immaterial whether the dash pot be secured to the fly-wheel or other parts with which the opposite connection of the dash pot has a relative movement.

Q. 5. Please carefully examine, if you have not already done so, "Complainant's Exhibit Defendants' Fly-wheel Governor" and state whether or not you understand the same entirely, its construction, purpose, and operation.

A. I have examined the exhibit referred to in question, and think I understand the same as to its construction, purpose, and operation.

Q. 6. Please compare "Complainant's Exhibit Defendants' Fly-wheel Governor" with "Complainant's Exhibit Complainant's Patent," having particular regard to the expression of invention covered by the single claim of this patent, and state whether or not you find "Complainant's Exhibit Defendants' Fly-wheel Governor" to contain the inventions, combinations, and devices covered and

identified by the claim of the patent in suit, and give concisely your reasons for any opinion you have arrived at or may express arising out of your comparison and investigation.

A. Upon an examination of "Complainant's Exhibit Defendants' Fly-wheel Governor" I find that it contains the weights mounted on pivoted levers, springs connecting said levers with stationary parts of the fly-wheel, so arranged as to exert a centripetal force in opposition to the centrifugal force of said weights, connecting rods joining the weights with a movable eccentric, which eccentric is for the purpose of shifting the valve, and a dash pot comprising
42 a cylinder attached to an arm of the fly-wheel, a piston working in the cylinder and provided with a hole through it, a piston rod leading through a stuffing box of the cylinder and connected to one of the weight levers of the governor. In practice I understand the dash-pot cylinder to be occupied by oil or other compressible liquid, and I also understand from the patent taken by defendant- that in practice said governor is adjusted to equilibrity or practical equilibrity of its centrifugal and centripetal forces. It therefore contains all of the elements of complainant's patent, arranged in substantially the same way, having necessarily the same mode of operation and adapted to produce the same results.

The only difference between complainant's and defendants' construction which can be urged to have any bearing whatever on the mode of operation of the device is that in defendants' governor the dash-pot piston rod is connected with the weight lever through the medium of a spring—that is to say, in defendants' piston rod is connected or formed a coil of heavy steel rod which will undoubtedly act as a spring if detached from this situation and subjected to endwise strain. Whether or not it does act appreciably as a spring in this connection I am unable to say, but whether it does or not the presence of this spring structure in the connection of the piston with the weight lever in no way alters the opinion which I have above expressed as to the essential correspondence between the defendants' fly-wheel governor and the structure described and claimed in complainant's patent. The dash pot of defendants' governor of necessity acts, and when it acts it of necessity acts to the same end and purpose of restraining and preventing excessive move-
43 ment of the governor weights under variations of steam pressure and work or load; wherefore I am of the opinion that said defendants' fly-wheel governor contains the invention set forth and claimed in complainant's patent.

I should further state that I have examined defendants' working engines provided with this improvement and also complainant's engines containing his improvements, as described in his patent, and that in both cases the governor is applied to a fly-wheel on the crank shaft of the engine and carrying the driving belt. It is impossible to determine without the use of instruments (which I have not applied) whether or not the alleged spring in the piston rod of defendants' engine yields or does not yield appreciably when the engine is running and the pressure or load is varied. The dash pot must yield under such varying conditions.

Both defendants' governor and complainant's governor are in practice provided with devices for adjusting the centrifugal and centripetal forces to actual or substantial equilibrium.

Defendants' counsel admit that the dash pot in defendants' construction is filled with oil or glycerine or similar non-compressible liquid, and also that the main centripetal springs in their construction of governor are adjusted as stated in letters patent No. 358,829, issued to F. H. Ball, dated March 8, 1887.

Adjourned to Tuesday, Jan'y 17, 1888, 10 o'clock a. m.

Tuesday, Jan. 17, 1888, 10 o'clock a. m., parties met pursuant to adjournment.

Present: Same as before.

44 Cross-examination by J. K. HALLOCK, Esq.:

X Q. 1. Referring to your answer to question 4, your description of the construction of steam-engine governors of the fly-wheel type, ending with the first clause on page 11, is in the nature of a statement of the state of the art as it existed at the date of the invention described in the patent in suit, is it not?

A. It is.

X Q. 2. Then, as you understand, it had been found impracticable to so adjust the centripetal and centrifugal forces of the governor as to give absolute theoretical tension?

A. It had been so found. To give stability to such governors, or, in other words, to prevent the rushing of the governor weights outward and inward, a very considerable deviation from the full theoretic tension of the centripetal springs had been necessary.

X Q. 3. Do you know whether or not from actual experience or from information derived from Mr. Ide a governor constructed in accordance with the Ide patent can be adjusted at full theoretical tension and have stability?

A. It can be adjusted so nearly to full theoretic tension that in the absence of the dash pot the governor would race or would lack the necessary stability. I believe it is thought desirable by Mr. Ide to adjust within one per cent. of absolute full theoretical tension to give the best results, while in the absence of the dash pot I understand that it would be necessary to adjust from five to ten per cent. below theoretic tension to obtain stability. Perhaps I should qualify the first sentence of this answer by saying that with the aid
45 of the Ide dash pot his governor can be adjusted to full theorectic tension without racing and strictly without instability, but with the result of at intervals changing its speed slightly and running at the same speed for a short time. This change of speed and brief maintenance of the same speed would arise from the ever-present fact of friction in the moving parts, to overcome which in setting such parts in motion always requires somewhat greater force than to continue their motion after being started; wherefore the best results are found, as above stated, in giving to the centripetal

springs a very slightly less tension than absolutely full theoretic tension.

X Q. 4. Has not Mr. Ide stated here this morning that he has found that if he adjusts his springs at full theoretical tension the engine will speed up and then speed down and be irregular, and that he has found it necessary to get the best results to not adjust his springs to full theoretic tension, and that he makes a variation from full theoretic tension generally of two per cent.?

A. His statement was not so loose and sweeping as given in the question, but more in accord with the concluding statement of my last answer. He particularly stated that the variations in speed would be very slight and that he usually set the springs at about one per cent. below full, absolute theoretic tension, though sometimes at two per cent. when the engine was going into possibly careless hands. He particularly stated in his remark referred to in the question that when his governor is set at full, absolute theoretic tension the variation in speed is so extremely slight as to produce no perceptible effect upon electric lights generated by power of the engine.

46 X Q. 5. Then Mr. Ide did say that if his springs were adjusted at full theoretic tension there would be variations in speed, did he not?

A. Yes; as above stated.

X Q. 6. Do you know what Mr. Ide means when he says that he adjusts his spring sometimes at one per cent. and sometimes at two per cent. less than full theoretic tension? What I wish to know is, what is that per cent. a percentage of?

A. As explained by Mr. Ide, he means that the variation in speed between no load and full load on the engine shall be one or two per cent. (as the case may be), due to the deviation from full theoretic initial tension of the centripetal springs.

X Q. 7. Then what Mr. Ide means by one or two per cent. is that his engine varies one or two revolutions to the hundred in its speed when the change takes place from no load to full load, the steam pressure being the same, is it not?

A. That is as I understand it.

X Q. 8. In comparing the "Complainant's Exhibit Defendants' Governor" with the Ide patent you will notice that there is a difference in the construction of the eccentric. Do you consider this difference when you say that the Exhibit Defendants' Governor contains the invention described and claimed in the Ide patent?

A. I do.

X Q. 9. Do you think that the construction of the eccentric is an immaterial matter in solving the question of infringement?

A. Entirely so.

X Q. 10. Have you noticed the fact that the eccentric in the
47 Ide patent is unsupported against the action of extraneous forces except by the dash pot—that is to say, that the eccentric in the Ide patent when the slot through it stands vertical is free to drop by the action of gravity, or if said slot stands horizontal or in line with the valve rod it is free to be moved by resistance ex-

erted from said rod, while the eccentric in the defendants' governor is at all times supported against the disturbing influences of extraneous forces, whether there is a dash pot used or not? In other words, to use the technical phrase, the eccentric in the Ide patent, were it not for the dash pot, is not "locked," while the eccentric in the defendants' governor is "locked" regardless of the dash pot?

A. The statement of the question with respect to the Ide patent is substantially true and the statement with respect to the defendants' governor is probably true. I, however, wish in the foregoing part of this answer to disallow the use of the word "locked" (which counsel has emphasized by quotation marks in his question) as expressive of either a necessity in this Ide governor or of the sole or principal or constantly executed purpose of the dash pot in his governor or patent. The eccentric, indeed, is not "locked" by Ide's dash pot, nor is it, properly speaking, "locked" in the double eccentric construction of defendants' governor. In the first place, the Ide patent says in effect that the extraneous forces referred to are those which disturb the movements of the valve when the forces of the weights and springs of the governor are "balanced." Reference is here manifestly had to the substantial equilibrity or so-called isochronism of the governor, which is the thing made first obtainable by the use of the dash pot.

48 Secondly, the patent distinctly says that at "a regular and very high speed of the governor wheel or pulley these disturbing (extraneous) forces operate but slightly, owing to the momentum of the weights, which serve to prevent their deflection from a regular course; but at lower speeds than that at which the apparatus is adjusted to run, and particularly in accelerating or retarding the engine, as in starting up or slowing down, these incidental disturbing forces interfere materially with the valve action and give an objectionable irregularity to the movements of the weights." In the regular or high speed of the engine it thus appears that the dash pot of the Ide patent cuts no appreciable figure with respect to these extraneous forces, and its sole work therefore at such speeds is practically to regulate the action of the governor with respect to the variations in load and steam pressure to which the engine is constantly subject. Even assuming that defendants' governor has a construction of the eccentric which, wholly or in part, supports the eccentric against the extraneous forces referred to in the Ide patent, the dash pot of said defendants' governor manifestly does at a regular or high speed of the engine just what Ide's dash pot does and is stated in his patent to do, namely, "to give a desirable steadiness and regularity to the movements of the movable parts of the governor as well as accuracy and reliability to the cut-off action of the valve;" and also, as elsewhere stated in the Ide patent, "by means of the dash pot applied to the relatively movable and stationary parts or to the unequally moving parts as described wide and sudden radial movements of the weights E′ are prevented, and as a consequence the governor will have a steady and efficient
49 action at all speeds of the pulley or wheel to which said governor is applied."

The "wide and sudden radial movements of the weights E'" mentioned in the last above quotation manifestly refer to the movements which would take place in a perfectly or closely balanced or equilibrious governor, as pointed out in one of my direct answers, and the quotation with that previously made clearly shows the primary function of the dash pot to be to give stability to the governor when its forces are thus balanced. This is precisely what defendant claims is accomplished in his governor having the dash pot, and as I do not understand that he claims for his particular construction of the eccentric the accomplishment of any part of this primary function, and as I also do not understand that the introduction of any improvement or change which relieves the dash pot of part of its work in supporting the eccentric against subordinate and disturbing forces relieves defendant- from the charge of using complainant's invention, I have stated and believe that the defendants' governor, having the dash pot of the same kind, in the same relation, and necessarily exerting the same restraints upon the movements of the eccentric with the same effect of controlling the valve and regulating the speed of the engine, contains the invention of complainant's patent.

In this connection I point to the fact that in defendants' patent 358,829, showing the Ide dash pot with defendants' supplemental springs, at lines 55 to 65, page 1, he says that * * * "the means for controlling the steam supply are operated by any of the well-known appliances in common use. The latter appliances I do not show, as they form no part of my invention, and their illustration is unnecessary to an understanding of my invention." This language refers to the eccentric and means to say that the eccentric may be single or double or variously constructed and connected, as then well known in the art. The construction of the eccentric present in the defendants' governor had been previously patented and therefore belonged to the prior art, and the foregoing admission of defendant made in his patent is substantially to the same effect as my own statements that the particular construction of the eccentric is not material in connection with the use of the dash pot.

X Q. 11. Please look at Fig. 1 of the drawings in the Ide patent and tell me what effect would be produced upon the eccentric, as shown there, if the governor balls or weights should be moved farther from the center of the wheel.

A. The effect would be to throw the eccentric across the shaft and change its angularity, the throw being in the drawing from right to left.

X Q. 12. Now, then, supposing the parts to be in the position shown in that figure in the drawing and the force was to be exerted upon the eccentric, which would move it from the right to the left, what would be the effect upon the balls?

A. To throw them out.

X Q. 13. Then any extraneous force which acts upon the eccentric to move it across the shaft to the right or to the left will produce a vibratory effect upon the weights or the balls, would it not?

A. That depends; at a high or normal speed of the engine it would not produce any appreciable effect upon the balls, be-
51 cause of their tenacious adherence to their circular course. At a slow speed of the engine, however, as in slowing down or in accelerating the speed of the engine, the action of such extraneous forces as would operate directly upon the eccentric with a tendency to carry it across the shaft would more effectively act to disturb the position of the balls.

X Q. 14. It was for the purpose of correcting this result of the action of extraneous forces exerted when the engine was running at moderate speed that this dash pot was added to the structure, was it not?

A. The question does not fairly state the fact, either as to the terms "moderate speed" or as to the implication of a sole purpose of the dash pot.

As to the former, the language of the patent is, "but at lower speeds than that at which the apparatus is adjusted to run and particularly in accelerating or retarding the engine * * * these incidental disturbing forces * * * give an objectionable irregularity to the movement of the weights." The obviation of irregularity of the governor from these disturbing forces was one of the results pointed out by Mr. Ide as being attained by his dash pot. But he distinctly states the broader and more general purpose of giving "a desirable steadiness and regularity to the movements of the movable parts of the governor" and preventing "wide and sudden radial movement of the weights E," which was a well-known peculiarity of equilibrious or so-called isochronous governors and giving "a steady and efficient action at all speeds of the pulley or wheel to which said governor is applied."

X Q. 15. Would not the result of an extraneous force acting upon the eccentric serve to move that eccentric from its steady and proper poised position?

52 A. Not in the regular speed of the engine to which the governor is adjusted. The engines of complainant have, I am informed, been run without the dash pot——

—. The witness is asked to answer the question. You have not been asked regarding the dash pot. I will, however, change the question slightly by inserting before the words "extraneous force" "a sufficient."

A. The words "a sufficient" now interpolated in the question are so vague and indefinite as to render an answer unintelligible or valueless. The forces which are present in the engine are the gravity of the eccentric when its slot is vertical and the inertia of the reciprocating parts or valve when the slot is horizontal. These forces are not sufficient to appreciably disturb the governor weights when the engine is running at the speed to which the governor is adjusted. These forces manifestly act or can act only through the briefest intervals of time or one at one quarter of the revolution and the other at the next quarter, then the first at the next quarter, and so on. Thus acting at the high or normal speed of the engine, they

can have no appreciable effect to disturb the position of the governor weights.

X Q. 16. You have not answered my question, but have repeated your answer to several previous questions. Now, this specification of the Ide patent says that there are certain extraneous forces which tend to change the position of the eccentric from its steadily poised position, but it says that when the engine is running at a "regular and very high speed" "these disturbing forces act slightly." Now, where do you find in this specification that there is any time when these extraneous forces do not act slightly or otherwise?

53 A. These forces manifestly are present or are being exerted at all speeds of the engine, but, as the patent in effect says, such forces do not produce any material disturbance of the position of the governor weights when the engine is running at a high speed to which its governor is adjusted, but that they do produce a disturbance of the position of the governor weights in accelerating and retarding the speed of the engine, as in raising the engine speed to that to which it is intended and adjusted to run or in slowing the engine down from such normal speed. This is all included in the sentence from which the question quotes.

X Q. 17. Does the specification not say also this invention "has for its primary object to provide means for holding the eccentric steadily in its proper poised position in opposition to the tendency of certain extraneous forces which are calculated to disturb the movement of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion"? Please answer directly.

A. It does.

X Q. 18. Where in the specification is there any secondary object of the invention named? I desire you to quote the passage.

A. The very passage quoted in the last question but one in its concluding words assumes an object back of that which is stated to be the primary object, namely, the object of balancing of the forces of weights and springs, or, in other words, a substantial equilibrious adjustment of the governor. At line 41 to the period in line 45, on page 2 of the specification, it is further said that

"by means of the dash pot applied to the relatively mov-
54 able and stationary parts or to the unequally moving parts, as described, wide and sudden radial movements of the weights E′ are prevented, and as a consequence the governor will have a steady and efficient action at all speeds of the pulley or wheel to which said governor is applied." This language points directly to the adjustment of the governor so as to give substantially an equilibrium to the opposing centrifugal and centripetal forces, for it was only in such a governor of those that were mechanically well made and properly applied that the "wide and sudden radial movements of the weights E′" or the racing of the governor would take place.

The patent does not mention this last-referred-to effect in terms as a secondary purpose, and I take it it is immaterial whether or not such a purpose or any other purpose which the patent says is

attained or which the machine is found to attain is classified in numerical order.

X Q. 19. Am I to understand that that is the only clause you can quote which can be construed as a declaration of a secondary object of the invention?

A. You are not to understand from me that the clause requires any construction, but that it appears to me to be a full, complete, unequivocal, and unmistakable declaration of an effect accomplished by the use of the dash pot. It is also to be understood from my answer that the sentence quoted by counsel from the Ide patent as stating the object of the invention contains the underlying assumption of a substantially equilibrious adjustment of the governor as lying at the bottom and as forming the basis of this invention or, perhaps more accurately, as being the structure to which the dash pot is added, with the effect of obviating the faulty
55 action of such structure, as stated in the clause which I quoted, as well as for holding the eccentric in opposition to the disturbing effects of gravity and inertia of the moving parts when the engine is running at less speed than that to which its governor is adjusted.

X Q. 20. Then the only openly declared purpose of this invention is to "provide means for holding the eccentric steadily in its proper poised position in opposition to the tendency of certain extraneous forces which are calculated to disturb the movement of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion," is it not?

A. This declared purpose is twofold, and includes the balancing of the centrifugal and centripetal forces of the governor, as well as the holding of the eccentric against the extraneous disturbing forces referred to. The statement which I quoted from lines 41 to 44, on page 2, in being a positive declaration of an effect accomplished, which is the effect upon the structure mentioned in the last three lines quoted in the question, is as much a part of the declaration of purpose as any words of the patent. I think a proper understanding of the first statement of purpose found in the patent and quoted in the question embraces or assumes the balancing or equilibrium of the governor, as well as the neutralization of the effect of extraneous forces.

X Q. 21. Do you understand that the balancing of the centrifugal and centripetal forces of the governor is effected by the use of a dash pot applied in the manner described in the patent or is something else required?

56 A. Something else is of course required. In fact the dash pot has nothing to do with balancing the governor. The balancing of the governor is accomplished by the proper selection and adjustment of the opposing weights and springs. The dash pot makes practicable a governor which is adjusted to a balanced condition or to substantial equilibrium.

X Q. 22. Now, please point out in the specification whatever language there is which would teach a person how to balance the cen-

tripetal and centrifugal forces of the governor by the proper adjustment of the weights and springs.

A. There is nothing in the patent which attempts to give this information, all that being a matter of common knowledge in the art.

X Q. 23. Then, there is no description of the means by which — you are pleased to call the underlaying secondary object of this invention is accomplished?

A. There is no description in the patent of means by which adjustment of the weights and springs is effected, if that is what the question calls for. The adjustment of the weights and springs or means for such adjustment is no part of the invention, either primary or secondary, but the object of the invention is to obtain several effects in an adjusted governor, and the means by which these effects are obtained is the dash pot.

X Q. 24. Do you wish to be understood as changing your previous answer, namely, the answer to X Q. 21, in which you say the dash pot has nothing to do with the balancing of the governor, but that it is affected by a proper adjustment of the weights and springs?

A. I do not.

MELVILLE E. DAYTON.

Subscribed and sworn to before me this 17th day of January, A. D. 1888.

FREDERICK C. GOODWIN,
[SEAL.] *Notary Public.*

57 United States Circuit Court, Northern District of Illinois.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.* } In Equity.

At Chicago, in the northern district of Illinois, on the 17th day of July, A. D. 1888, at 10 o'clock a. m., before me, Frederick C. Goodwin, a notary public within and for Cook county, Illinois, residing in Chicago, in said district, at the office of Offield & Towle, room 99, No. 185 Dearborn street, Chicago, Illinois.

Present: C. K. Offield, Esq., on the part of said complainant, and J. K. Hallock, Esq., on the part of said defendants.

And thereupon the following proceedings were had before me, pursuant to agreement of counsel:

Complainant's counsel calls as a witness WILLIAM H. HOFFMAN, who, by me being duly sworn to testify the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by Mr. OFFIELD:

Q. 1. Please state your name, age, residence, and occupation.

A. William H. Hoffman; age, 52; Yonkers, N. Y.; occupation, consulting engineer; business, New York city.

Q. 2. For how long a time have you followed the profession or

pursuit of consulting engineer and how constantly and actively have you been so engaged during that time?

A. I began the business of consulting engineer on my own account about the year 1873. I followed it continuously until the year of 1882.

58 Q. 3. Please state how familiar you are and generally what has been your experience with the construction and operation of steam-engines and all their parts in this country and the application of such engines to the various industries and purposes for which they are designed.

A. I began in the steam-engine business as an apprentice in the works of the Woodruff & Beach iron works, at Hartford, Conn., in March, 1854, both in the machine shop and drawing-room; worked on automatic cut-off engines for all stationary purposes and marine engines; became familiar with the erection of the engines in cotton, woolen, and paper mills; also silk mills, brass-rolling mills, and like industries; became familiar with the use of the indicator for determining the action of the valves, measuring power, and determining the economy of engines; made designs in the drawing-room of various forms of automatic valve gear, including the governors and all the main details; was sent out to examine and correct errors on engines after they had been erected and started with the load on; visited engines of different types for the purpose of comparing their economy and stability in regulation with other automatic engines; have had charge of the construction of several types of automatic valve gear. As superintendent of an automatic engine establishment, I had charge of the building, assembling, and erection and final completion on the foundations of one of the well-known so-called high-speed engines, patented by Mr. J. W. Thompson, of Salem, Ohio, and licensed by him or his employers or associates to the Hartford Engineering Company. The initial and most of the designs for these engines emanated from the works of the Buckeye Engine Company, of Salem, Ohio, and I believe

59 originated with Mr. Thompson, to the best of my knowledge.

In the contract made by the Buckeye Engine Company with the Hartford Engineering Company the designs furnished by the Buckeye or parent company, as they were termed, were to be strictly and rigidly adhered to by the Hartford Engineering Company and no changes in the valves, valve gear, regulating device, steam cylinder, and parts connected with it without the full knowledge and consent of the Buckeye Engine Company of Salem. When I assumed control of the production of these engines at the Hartford Engineering Company I found that they had completed a number of engines, and that there was a large number of details for various sizes of engines in the shops and store-room in various stages of completion. I remained with the Hartford Company from Sept. 25, 1882, until June 18, 1884, and then resumed my profession as a consulting engineer and continued to practice it in various States in the Union ever since.

Q. 4. Are you a member of any society of recognized standing relating to your profession? And state whether or not during the time

you have followed that profession you have read and followed the literature and scientific publications in this country relating to the problems and questions of that profession.

A. I am a member of the Society of Mechanical Engineers of this country, and I own and have read most of the standard works relating to steam engineering in all its branches. I am a regular contributor to columns of the American Machinist. It is the principal publication in mechanical engineering now.

60 Q. 5. Between Sept. 25, 1882, and the year 1884 were you exclusively in the employment of the Hartford Engineering Company?

A. I was.

Q. 6. During that time did the Hartford Company build any other engines except those of the Buckeye Engine Company of Salem, Ohio, and under their plans and dictation?

A. None except six vertical link-motion marine engines designed by me and one small engine that I rebuilt as an experimental engine for the purpose of testing a balance valve.

Q. 7. During the time you were with the Hartford Engineering Company were you entirely familiar with these Buckeye engines, their construction and operation in all their parts so far as such engines were constructed, built, or handled by such Hartford Company?

A. I was familiar with the engines.

Q. 8. Have you read, so that you understand fully, the depositions given in this case on the part of the defendants by Joseph W. Thompson, Harris Tabor, Edwin H. Schneider, and Wm. Steel, relating to the Buckeye engines in connection with other matters?

A. I have.

Q. 9. Have you examined carefully, so that you understand the same, the two exhibits offered in evidence in this case under the deposition of Mr. Thompson and marked "A" and "B"—"Defendants' Exhibit A" and "Defendants' Exhibit B"?

A. I have.

Q. 10. While you were in the employment of the Hartford Engineering Company did that company or the Buckeye Com-

61 pany, to your knowledge, construct any engines with governors or put in any governors in the engines they constructed alike or similar in any respect to "Defendants' Exhibit- A and B" as any part of their engine construction?

A. They made a governor similar in form and mechanical arrangement, but none like "Exhibits A and B."

Q. 11. In what manner and to what portion of the engine mechanism was this governor attached?

A. The governor was attached to the main shaft and was formerly made in the form of a disk bolted on in halves; then as a disk, with openings cast through the disk plates, leaving arms to connect the hub and rims together, and afterwards, in 1882, in the form of a wheel with a narrow rim. The moving parts of the governor were fastened to the arms of the disk or wheel which was called a

governor casing, the object of the casing being to prevent injury to the operator in charge of the engine.

Q. 12. Did this disk or casing on the Buckeye engine serve any other purpose, object, or result than simply a base of support and housing for the governor itself?

A. None whatever.

Q. 13. Do you know what that device is, commonly called a dash pot as applied to governors of engines?

A. I do.

Q. 14. Do you recognize generally such description of dash pot as appearing in "Defendants' Exhibits A and B"?

A. I recognize such attachment on those particular exhibits.

Q. 15. Was any dash pot as this or any other description
62 as appearing in those exhibits ever placed on any engine manufactured or handled by the Hartford Engine Company while you were in their employment, between September, 1882, and 1884?

A. None was ever built or applied to any governor built by them while I was in their employ.

Q. 16. Do you know of the Hartford Engineering Company ever using a dash pot in connection with their housing-disk governor; and, if so, under what circumstances and necessities such dash pot was applied and used?

A. I know that the Hartford Engineering Company never built or applied a dash pot of any design or description to an engine in construction in their works, but the Buckeye Engine Company of Salem rebuilt a pair of old engines formerly built by the Woodruff & Beach iron works, of Connecticut. After the engines were erected and started with a load they raced, by the imperfect action of the governors, to such an extent that the carpet company found it very difficult to run their machinery without liability of damage to the machinery and stock. They informed the agents of the Buckeye Engine Company as to the trouble with the engines, and the engine company endeavored to correct the errors by the adjustments of the weights and springs in the governor disks or casings. They found it impossible to make the engines run satisfactorily, owing to the inertia in the governor's moving parts and attachments, cut-off valves, etc., which had to be overcome, besides the excessive friction of the cut-off valve stem where it passed through the hollow main steam-valve stem and where there was a long stuffing box to prevent the steam from escaping from the main steam valve, which was hollow, through the hollow valve
63 stem to the atmosphere. When the stuffing box was set up hard enough to make the packing tight it caused the small cut-off valve stem to wear away very rapidly, being reduced sometimes a sixteenth of an inch in diameter at a point where it traveled in the packing of the stuffing box. The result was that the elastic packing expanded itself tightly into this shoulder, worn in the stem, thereby causing such a frictional resistance that it was impossible to prevent the governors from racing to an excessive degree. In a consultation between one of the agents and Mr. Wm. Steel,

the chief engineer of the Hartford Carpet Company, Mr. Steel suggested to the agent of the Buckeye Engine Company that a dash pot containing oil or some other fluid and similar to those used on regulators or fly-ball governors for slow-speed engines might assist them in overcoming their difficulties. The agent of the Buckeye Company then and there empowered Mr. Steel to try the experiment of a dash pot and told Mr. Steel to build it in the shops of the carpet company at the expense of the Buckeye Company, which Mr. Steel did. When the dash pot was completed Mr. Steel applied it personally to the engine and it proved to be a success to the fullest extent expected by him.

Q. 17. Then, as I understand you, the perfect success you speak of consisted solely in two things—first, the application of the dash pot to the housing-disk governor prevented the engines from racing and wrecking themselves and thus curing the defect in the design and construction of the engine itself; second, the application of the dash pot to this housing-disk governor made or permitted the gov-
64 ernor itself to become practically operative by overcoming the inertia of its parts and its connecting valve-stem mechanism. Is this correct?

A. That is correct. I should have said control and not overcome the inertia for the purpose for which the engine was used.

Q. 18. If these Buckeye engines had been reasonably perfect in their mechanical construction and design, not only as to the engine itself, but as to the governor devices, would there have been any necessity for applying the dash pot to the casing governor to remedy such defects as far as possible and make the engine operative?

A. There would have been no use for the application of the dash pot if proper design and construction, as you have suggested in the question, had been carried out—that is to say, for all ordinary mill-driving purposes. I proved this by substituting larger governor casings for the small ones that were in the original designs, in which I was enabled to get the weights further from the center of the shaft, and by this means I could reduce their weight, which gave me the opportunity of overcoming some of the inertia in these very important details. I was also enabled to make the swinging arms lighter and by reducing the diameter of the weights I brought the center of them nearer the center of the governor casing, and this prevented in a great measure the springing of all the joints and pins on which the principal parts of the governor moved. I also brought the center of the cut-off eccentric nearer the center of the weight arms, thus doing away with a large part of the friction caused by the excessive overhang.

Q. 19. Is this "Defendants' Exhibit B" constructed to any
65 scale or a fair representation in proportion of any governor-containing disk used by the Buckeye Engine Company?

A. It is not in proportion to that used by the Buckeye Engine Company or that used by the Hartford Engine Company. The practice carried out by the Buckeye Engine Company and the Hartford Engineering Company would call for a governor casing from 4½ to 5 times the diameter of the shaft, though originally they

were only about 4 times the diameter. For instance, a 16 x 24 engine, the governor casing would be from 34 to 36 inches diameter, the shaft being about 8 inches in diameter. For the size of shaft on "Exhibit B" the diameter of the disk or governor casing would be from 5 to 5¼ inches diameter.

Q. 20. Then, as I understand you, there was no occasion or use for any other support than standards or arms for support of the governor and dash pot on the Hartford Carpet Company engines, and the casing was put on simply as a guard and protection against injury to the engineer or attendants about the engine. How is this?

A. Those are the facts. So far as the operative parts of the governor is concerned on the Hartford Engineering Company's engines, all of the moving details of these governors could have been suspended or attached to radial arms extending from the hub and the lever pins, and spring fastenings could have been arranged to spring from these radial arms, while the outer periphery or rim of the governor casing or disk could have been entirely removed and still left the governor intact for action.

Q. 21. Were or could those governor-containing disks of the Hartford Company engines — used for the purpose of transmitting power or for any other purpose than described by you?

66 A. They were not and could not be used for any other purpose than that described by me.

Q. 22. What were the size and weight of the fly-wheels respectively of the Hartford Company engines upon which these governor-containing disks are contained?

A. We will take for example the 16 x 24 inch engine heretofore cited. The fly-wheel pulley or band wheel was 8 feet in diameter and we usually put in this wheel (calculated in the rim) from 6,000 to 7,000 pounds, according to the work we were driving.

Q. 23. How wide was the rim of the fly-wheel pulley?

A. The rim of the fly-wheel pulley was from 21 to 25 inches in width, according to conditions.

Q. 24. When you changed the form of support for the governor from a disk to a wheel where were the spokes of such wheel located with reference to the edges of the periphery?

A. The spokes were located much nearer one edge than the other, thereby forming what is termed an offset rim, this offset being for the purpose of safely encasing the moving parts of the governor. This offset is another reason for making the device impracticable as a power wheel.

Q. 25. How was this containing disk on the Hartford engines made as to its parts and how and where secured to the shaft?

A. The containing disk was made in two parts, or, as technically termed, in halves. On the hub and at the rim at each half were flanges through which the clamping bolts passed. These clamping bolts, together with set-screws, held the disk in its proper position in a radial direction as near the main eccentric and main bearing as possible, the cut-off eccentric of course being placed between

67 the disk and the main eccentric in a longitudinal direction.

This disk was so constructed that it is not adapted to any driving, lateral, or torsional strain.

Q. 26. Were the fly-wheels of the Hartford Company and the Buckeye Company, so far as you know, also pulley or band wheels?

A. It is an invariable custom with all engine-builders of New England to make the fly-wheel serve also as a pulley or band wheel.

Q. 27. How many engines did you superintend the construction or making of of the Hartford Company while in their employment?

A. About eighty.

Q. 28. Were there any drawing sketches or descriptive material of any kind in the offices or possession of the Hartford Engineering Company which related in any manner to application of dash pots to governors?

A. There were none of any kind.

Q. 29. What are the essential characteristics of a fly-wheel, whether used as a driving pulley or band wheel, which distinguishes it from any other device which can be attached to the shaft, such as the governor-containing disk you have described?

A. The particular and peculiar office of a fly-wheel may be considered, first, as a reservoir for stability of motion, inasmuch as we are compelled to use it on automatic engines and all others as an absorber of initial energy and as a distributor of this energy at different points of the crank circle, which is absolutely necessary, owing to varying steam pressure throughout the stroke. It also, if properly placed on the shaft next to the main bearing of the
68 engine, absorbs the initial shock of the entering steam, and thus relieves the pressure on the main journals on each center point of the stroke. As to proportions of fly-wheels, I have found that any diameter less than three times the length of the stroke of the piston will not assist in steadying the motion of the engine to any practicable extent, and at that diameter I found that the excessive weight and pressure on the journals, with the attending extra friction, could not be compensated for by the rotative effect of the rim. The proper proportions for fly-wheel pulleys which give the best results where close regulation is absolutely necessary are where the diameter of such pulleys are four times the length of the stroke and where the rims of such pulleys are calculated for a weight of from 65 pounds to 100 pounds per intended indicated horse power, according to the speed. Any device which can be attached to an engine shaft and revolving therewith which does not have all of these characteristics and general proportions cannot be considered, and is not, in fact, a fly-wheel in any sense of the term or for any practicable operative purpose.

Q. 30. What is the necessity, if any, for an equal distribution of weight throughout all parts of the fly-wheel or driving pulley?

A. It is absolutely necessary that a fly-wheel should have its weight uniformly distributed throughout the whole structure; otherwise the effect sought for will be neutralized, and the whole machinery of the engine will be jeopardized from the constant liability of the self-destruction of the wheel, which will be surely thrown apart by the consequent undue centrifugal force.

69 Recess.

Q. 31. While you were with the Hartford Engineering Company did that company have an engine in the Hartford Manilla Company's establishment in which a dash pot was put in the governor-containing disk or wheel to cure the same defects and serve the same purpose you have described?

A. The manilla company had such an engine, and there was a dash pot put into the governor of that engine several months after the one was applied to the carpet company engine.

Q. 32. Mr. Tabor, defendants' witness, in speaking of these disks on the Hartford Company's engines, states that he knew "that incidentally it did have the functions of a fly-wheel," in answer to X Q. 77. Is this assertion of Mr. Tabor's true in any respect?

A. No disks of the diameter and weights of those mentioned or referred to can have the functions of a fly-wheel, so that the statement is not true.

Q. 33. What do you know about the Buckeye engines set up in the grain elevators, known as Dow's stores, in Brooklyn, N. Y., testified to by Mr. Schneider, defendants' witness?

A. I know that there were a pair of Buckeye engines erected in Dow's stores.

Q. 34. When were you familiar with those engines?

A. For several months during the year 1880.

Q. 35. Can you locate the last time in 1880 when you examined those engines in Dow's store?

70 A. The last week in December, 1880; after Christmas.

Q. 36. Was there any dash pot in any governor-containing disk in either or any of those engines at Dow's stores at that time?

A. There was not.

Q. 37. What do you understand by the meaning of the term "fly-wheel governor"?

A. I understand that a fly-wheel governor is one in which the governor mechanism is placed, attached, or suspended in the fly-wheel pulley or driving fly-wheel itself and is substantially a part thereof.

Q. 38. Please look at the wood cut now shown you and state what it is or what it represents, if you know.

A. The cut represents what is termed by the builders a girder frame, automatic Buckeye engine.

Q. 39. What is the large wheel appearing in this wood cut, its purpose and designation?

A. It is a fly-wheel pulley for the purpose of transmitting the power by belt from the engine to the machinery to be driven.

Q. 40. What does the small, light wheel with its weights and springs, appearing in this wood cut as being interposed between the fly or band wheel pulley on the bed of the engine, represent?

A. It represents a disk or case for carrying the governing mechanism and for protecting the engine attendant when his duty calls him to examine it while it is in motion.

Q. 41. Is this wood cut a fair representation as to proportion and parts of that Buckeye engine?

A. It is a fair representation as far as the cut shows.

71 (Complainant's counsel here offers in evidence the wood cut identified by the witness, and requests that the same may be marked "Complainant's Exhibit Wood Cut Buckeye Engine.")

Q. 42. Please look at the catalogue now shown you and state what it is.

A. It is a catalogue which is issued by the Buckeye Engine Company of Salem, Ohio, containing engravings and descriptions of the different styles of engines built and offered for sale by them now.

Q. 43. Please examine carefully each of the wood cuts or engravings appearing in said pamphlet or Buckeye circular, and state whether or not such wood cuts are fair representations as to proportion and relation of parts of the different Buckeye engines now manufactured by that company.

A. These are fair representations of the various types and styles that the Buckeye Engine Company are making at this time.

(Complainant's counsel here offers in evidence the catalogue just identified by the witness, and requests that the same may be marked "Complainant's Exhibit Buckeye Engine Catalogue.")

Q. 44. What kind of a governor located in that containing disk by the Buckeye Company was it—I mean what was it called and why so called?

A. It was called a shaft or disk governor for the reason that its governing mechanism was fastened to what is known by mechanics as a disk, and was called a shaft governor usually because it was fastened directly to the main shaft of the engine.

72 Q. 45. Do either of the wood cuts of the Buckeye Engine Exhibit Catalogue illustrate the engine of the manilla company or carpet company as to general style? Which cut approximates the most closely?

A. Figure 4, on page 8, approximates closely to the manilla company's engine, but in the Hartford Carpet Company's engine figure 5, page 9, represents the cylinder rock-shafts and valve gear, but the bed was an old-fashioned Woodruff & Beach bed and the disk containing the governing device was of the closed plate type as first built by the Buckeye Company. The fly-wheel is removed in this cut, as shown by the broken lines on the shaft.

Q. 46. I notice that in figures 10 and 11 in this Buckeye catalogue there are two fly-wheels located on the shaft. What is the object of this or in all engines containing two fly-wheels or pulleys?

A. The object is to drive or transmit power to two machines or two sets of machinery, as the case may be, from one main engine shaft. The cut, figure 11, however, represents an engine with two wheels on the main shaft for transmitting power; the wheel next to the engine frame is a fly-wheel pulley and contains the regulat-

ing device as a part thereof. The wheel next to the back pillow block appears to be a driving wheel. The application of the governor or governing device, as represented in figure 11, was made by the Buckeye Company for the first time last winter to the fly-wheel pulley.

Q. 47. Are you familiar with the letters patent in suit granted to the complainant, Albert L. Ide, July 8, 1884, and No. 301,720 for an improvement in steam-engine governors to the extent, at least, that you understand the construction and operation of the
73 parts and devices therein shown and described and the purpose, use, and relation of such device to a steam-engine in which they may be embodied?

A. I have read such patent papers and am familiar with the specification, drawings, and claim and the object sought to be obtained by the invention.

Q. 48. Is it plain to you that an engineer skilled in the art to which this invention relates, from the examination of said patent, particularly to the drawings thereof — what kind of a power wheel is identified by such patent is to be used in connection with the governor and dash-pot mechanism therein identified? And please give your reason for any statement that you may make.

A. On examination of the drawings, together with specification, I find that it is perfectly evident that the device to which his governing mechanism is attached is a fly-wheel pulley, serving all the purposes of a fly-wheel, also a pulley, or it can be used as a fly-wheel alone, the power being transmitted to the shaft by some other mechanism besides the belt in the case of its being used only as a fly-wheel. My reasons for knowing the drawings to represent a fly-wheel pulley are as follows: First, the wheel has a large diameter compared with the diameter of the shaft; next, it has a wide rim to carry a belt. This rim is also designed as a fly-wheel on account of its extra thickness as on the scale. The thickness of the rim is one-half the diameter of the shaft, which is a common proportion for such fly-wheel. Again, the drawing shows this wheel to be a fly-wheel or fly-wheel pulley, for the reason that the arms connecting the rim and the hub are shown very strong and thick, such proportions being necessary in all fly-wheels.

74 Q. 49. What significance does this increase or proportion of metal in the rim of the wheel of the Ide patent have in determining the identification of the fly-wheel?

A. The appearance of this extra thickness in the rim of the fly-wheel shows conclusively that the inventor had very properly calculated to put the necessary weight as far from the center of the shaft as possible. It must be understood, in calculating the weight, the effective portion taken per horse power or as a total must be located in the rim of the wheel, and therefore it is a practice with engineers familiar with the designing of fly-wheels to leave out of their calculations all hubs, segment flanges, and one-fifth of the lower sections of the arms, for these last-named details of a fly-wheel do not, as a fact, in practice, add to the effectiveness of the wheel in performing its duty.

(Counsel for defendants objects to the last two questions and answers, as a matter inquired of should have been contained in the complainant's *prima facie* case, and is not in rebuttal of any testimony given by defendant.)

Q. 50. I see that the Ide patent in suit refers particularly to the employment of the inventions identified by the claim of that patent to the cases of engines used for running a dynamo for electric-lighting purposes. Are you familiar with the system of electric lighting as now employed, having for its power steam-engines?

A. I am familiar with electric lighting and with engines that are used in such service.

Q. 51. In your opinion, will the association and combination of devices expressed in the single claim of this Ide patent, when embodied in an engine used for running a dynamo for electric-
75 lighting purposes, accomplish and assure the results and ends entirely claimed therefor in the specification of this Ide patent?

(Defendants' counsel objects to the question as improper, not being in rebuttal of any evidence presented by defendants.)

A. I am positive that this single claim will accomplish all of these results fully.

Q. 52. Mr. Hoffman, what invention, advantage, and improvement is there or was there in discarding the old governor containing disk or wheel, with its dash pot, as shown in the old Hartford engines, and combining the fly-wheel or fly-wheel pulley with the governor and dash pot as a concrete unit, as expressed and identified in the single claim of the Ide patent in suit? Please state the facts as you know them to be and your reasons as a mechanical engineer therefor in connection with such statement of facts.

Objection continued.

A. The advantages gained in discarding the old governor disk or casing, as made on the Hartford engines and Buckeye engines at Salem, and substituting therefor a combined governor or fly-wheel pulley are many, principally among which are the increased diameter of the structure, which enables us to place our weights at a long distance from the center of the shaft, thus reducing the weight of these weights and this reduces our inertia. The arms can be longer and lighter if necessary; the pin journals are subjected to less wear, as they are supporting less weight; the springs can be longer if desired, and the whole friction of the moving parts can be materially reduced where we have a large circle to work in. For instance, in making connections from the weight levers to
76 the cut-off eccentric the angles of these connections will be very moderate compared with those placed in a small governor casing, thus relieving the pins and journals a large amount of frictional resistance, which is equivalent, of course, to the reduction of the inertia. Then, again, having a fly-wheel or fly-wheel pulley as the structure to which we attach our moving mechanism of the

governing device, we have absolute rigidity, so that as the weights move out with their centrifugal force and as the springs retard with a centriputal force and as all the connections are affected by the centrifugal force, such as the swaying of the springs, etc., they are prevented by this rigid structure, the fly-wheel, from being thrown from their true alignment, and this again prevents a large amount of friction, which is always present in the old style of disk or shaft governors where the mechanism is attached to a very light structure. Another great advantage in locating the governing device in the fly-wheel or fly-wheel pulley is that it is necessarily located next to the main bearing of the engine. The fly-wheel placed at this point becomes a receptacle for the initial shock caused by the steam when it is admitted to the cylinder. With the old arrangement the governing disk or case was necessarily placed next to the main bearing, while the heavy fly-wheel was, by the nature of this arrangement, moved far away from this bearing, where it could play but little or no part as an absorbent of the initial shock of the entering steam. This shock is entirely or at least mostly removed from the main bearing of the engine at each dead-center point, thereby reducing the friction on the main journals from 12 to 15 per cent. As regards adjustment where the governing device is located in the fly-wheel pulley, the advantages are obvious.

77 As our inertia is so greatly decreased, the adjusting screw sliding blocks for springs and all dash-pot attachments can be materially reduced in size and the location of the dash pot can be such that its convenience of adjustment is materially increased and the friction of the piston in its cylinder will be brought to a minimum, especially that caused by its centrifugal action in its revolution. Another point of gain is in the economy of manufacturing, as the method of combining the governing device with the fly-wheel or fly-wheel pulley gives us one piece less upon the shaft, permits us to shorten the shaft, gives us a narrower foundation, and consequently less ground space. This will certainly represent a total saving of six per cent. in the cost of the engine and its erection.

The system of electric lighting has made necessary, in a great measure, what is known as a self-contained engine. A self-contained engine is one in which there is usually a center crank with a bearing on either side of it, said bearing being a part or portion of the main bed plate of the engine. On the outside of both of these bearings are placed fly-wheel pulleys, one on each side, and one of these pulleys, in many cases, contains the governing device of the engine. This type is called the automatic self-contained engine. It is absolutely necessary in this type of engine that the governing device shall be in one of these pulleys, as it would be unmechanical to attempt to arrange a disk or governor case on either side of the main bearing or fly-wheel pulleys, and would be attended with increased friction and failure as to the necessary regulation for successful electric lighting. There is another type of self-contained engine, as shown in figures 10 and 11, Buckeye Engine catalogue, in

78 which the outer bearing carries the rear end of a shaft placed

on one side of the engine, and these cannot be as economically constructed and operated with a separate governor disk or casing, like figure 10 in Buckeye catalogue, as they can be if constructed like figure 11 in same catalogue, where the governing device is placed in the fly-wheel pulley immediately next to the engine. In my opinion and from my personal observation and examination, the method of constructing a governor in combination with a fly-wheel and dash pot, substantially as shown and described in the patent of Mr. Ide and pointed out in his claim, will give closer and more uniform regulation for all service which a steam-engine is required than any device or invention or combination that I have ever seen, and this closeness of regulation is practically necessary in all systems of electric lighting.

Adjourned until Friday a. m., July 20th, 9.30 o'clock.

FRIDAY, *July* 20, 1888—9.30 o'clock a. m.

Met pursuant to adjournment.

Present: Same as before.

Q. 53. Are you acquainted with or have you ever seen the Ball engine, as now built by the defendants in this case?

A. I have seen two Ball engines that I suppose are called his present standard type for electric lighting. One was in motion, the other was idle.

Q. 54. When did you last see such Ball engines and examine them so as to know the construction and operation of their parts?

A. On Tuesday, the 17th of the present month.

Q. 55. Please look at the wood-cut representation on the face of the exhibit marked "Defendants' Exhibit F," E. R. McCart-
79 ney, notary public in and for city and county of New York, and below such endorsement thereof, and state whether such wood cut on said exhibit represents perfectly and accurately such Ball engines, so far as it professes to represent the same.

(Counsel for defendant- objects to the question as improper in rebutting testimony unless the purpose of the question is to show that the cut is not a proper representation of the engine.)

(Complainant's counsel asks defendants' counsel if he will admit that such wood cut is an accurate and correct representation taken from photograph of engines constructed by defendants since the year 1884.)

(Defendants' counsel answers that he does admit that the wood cut on the first page of the Exhibit F is made from a photograph of a Ball engine made since 1884, and that the engraving is as correct as engravings of that scale usually are. I do not notice any inaccuracies.)

A. It represents fairly the engine examined by me on the 17th of July inst.

Q. 56. Please examine carefully the pulley or band wheel carrying the governor and dash pot shown in this wood cut on "Defendants' Exhibit F" and state whether or not such wheel is a fly-wheel,

and give your reasons for the statement, and whether or not the pulley wheel carrying such parts on the Ball engine you saw on the 17th inst. was a fly-wheel, and give your reasons therefor.

(Defendants' counsel objects to the question for the reason that the only object in asking it must be to prove infringement, and this should have been done in the *prima facie* case.)

80 A. The fly-wheel pulley shown on the cut in which the governing mechanism is placed is a fly-wheel and the pulley shown on the opposite end of the shaft of the same cut is also a fly-wheel. My reasons for this statement are that the diameter of the wheels on the engines examined by me on the 17th inst. are about five times the length of the stroke of the engine, or, in other words, they are sixty inches in diameter or thereabouts. Another reason is that the rim is made thick enough to answer as a fly-wheel in both wheels. The arms are also strong enough to resist the centrifugal forces always present in a moving fly-wheel. The rims are wide enough to carry belts for the transmission of the power from the engine to the machinery driven, and this characteristic enables us to call them fly-wheel pulleys. There can be no mistake as to the office of these wheels, as the weight in these rims, which is about 1,500 pounds, combined *and* with the diameter of the rims justify me in making this assertion.

Q. 57. Did you measure and calculate the weight of those fly-wheels on the Ball engine you have mentioned, and is your statement of the weight of such rims based upon your examination?

A. I did measure the rims in question, and my statement as to the weight is based on those measurements.

Q. 58. What does this extra weight in the rims make certain as a fact?

A. It makes certain that these rims are fly-wheel rims and not simply pulley rims, as the weight is far in excess of that needed for a pulley used simply to transmit power with the belt.

Q. 59. Please examine the wood cut shown on the face of
81 "Defendants' Exhibit E" and on pages 11 and 40 of such exhibit and state what kind of a device or wheel appears in such representation of the Ball engines carrying the governor mechanism, and give your reasons for such statement.

A. The pulley, as shown on front of catalogue and pages 11 and 40, carrying the governor, is simply a light-power pulley of the same pattern as any ordinary power pulley placed on a line shaft, with the exception that it carries the governing device for the engine and in consequence may have the rim extended on one side to protect the attendant from the moving parts of the governor in their revolution. There is a fly-wheel represented in these cuts placed on the opposite end of the shaft from that containing the pulley. This fly-wheel is the only one represented in these cuts, and if it was removed it would be impossible to run the engine with any load, as the light pulley containing the governor could in no way serve as a fly-wheel, its diameter and weight of rim being entirely inadequate for such service.

Q. 60. Please look at "Complainant's Exhibit Defendants' Fly-wheel Governor" and state whether or not said exhibit represents the fly-wheel or fly-wheel pulleys which you saw and examined on the 17th inst. on the Ball engines and give the scale and proportion of this "Complainant's Exhibit Defendants' Fly-wheel Governor" compared with the fly-wheel carrying the governors on the Ball engines.

A. I find the model before me to be constructed in all its details very nearly as to proportion and scale to the measurements made by me from the Ball engines on the 17th inst. The model is made on the scale of 3 inches to the foot or one-fourth size and
82 represents a fly-wheel pulley 4 feet in diameter and about 8 inches face. The shaft is 4 inches in diameter; the wheels of the Ball engine measured on the 17th are a little larger in proportion to the size of shaft than the model, as the shaft on the Ball engine is slightly under five inches in diameter, while the wheel is sixty inches in diameter and has a face of thirteen inches. The governor mechanism, including the dash pot, on the Ball engines measured is on about the same scale or proportion as the model, and I find by comparing the measured wheels and model with the cuts on the face of the catalogue "Defendants' Exhibit E" and pages eleven and forty of the same that it would be impossible to place governing mechanism, including dash pot, of the size measured on the Ball engines on the 17th inst. and that shown by scale by the model in the light-power pulley shown in these cuts and which is represented as carrying the governing mechanism. I arrive at this conclusion by comparison, by comparing the details of the engine as shown in the cut with the light-power pulley carrying the governing mechanism.

Q. 61. Please examine, if you have not already done so, "Defendants' Exhibit C," being letters patent issued to Frank H. Ball, dated March 8, 1887, and No. 358,829, for an alleged useful improvement in steam-engine governing devices, and state whether or not you understand the construction and operation of the devices therein shown and described.

A. I have examined "Defendants' Exhibit C" and understand the construction of the same.

Q. 62. In your opinion does the interposition of the spring marked "E" in the patent in connection with the piston of the dash
83 pot serve or can it serve under any construction or circumstances any practical purpose? And give your reasons fully for your statements and conclusion.

A. It does not and cannot. The spring as shown in the drawing is a part of the dash-pot piston rod and cannot serve any useful purpose in connection with said dash pot for the reasons that if it is made elastic or flexible enough to be susceptible to elongation and compression from the work or force transmitted to it by the action, movement, or travel of the dash-pot piston or the weights and levers it would entirely neutralize and utterly defeat the objects sought in applying a dash pot to a governor. On the other hand, if this spring is made stiff or rigid it then merely becomes a part

and portion of the dash-pot piston rod of a spiral or twisted form. In this form the spring becomes not only a detail of no use, but presents itself as one of absolute detriment, as it adds weight to a point where lightness is very desirable. It adds frictional resistance quite largely, as its weight is under the influence of centrifugal force in the same manner that the levers and governor weights are. Now, the action of the centrifugal force collected by the weight of this spring is to press the dash-pot piston rod and all its attachments towards the periphery of the fly-wheel, and in so doing the piston rod and piston are thrown against the sides of the stuffing box and dash-pot cylinder, thus increasing the frictional resistance and introducing another disturbing element in the governor.

Q. 63. Please look at the device now shown you and state what it is and what it represents.

A. It is a dash pot with piston rod and conn ecting joint, stuffing box, etc., as shown in the Ball patent.

84 Q. 64. How closely does this device compare with the dash pot and piston-spring attachment that you saw in position on the Ball engine on the 17th of this month?

A. The dash pot before me, together with its piston rod and spring connection to same, is very similar to those examined by me on the Ball engines on the 17th inst., the difference being in the matter of dimensions in both the dash pot and spring, the difference in the spring being that the one on the engines examined was one-eighth of an inch larger in diameter and one-fourth of an inch longer. The outside diameter of the dash pot was one and one-fourth of an inch larger than the exhibit. The size of the spring coil or wire was seven-sixteenths of an inch in both cases.

(Complainant's counsel here offers in evidence the device identified by the witness and requests that it may be marked "Complainant's Exhibit Defendants' Full-sized Dash Pot and Spring.")

Q. 65. I now call your attention to a comparison between "Complainant's Exhibit Defendants' Fly-wheel Governor" and the combination of devices covered and identified by the single claim of the Ide patent in suit and ask you whether or not there is any substantial difference in mechanical construction, object, and result between the invention or mechanical combination covered by that claim and the "Complainant's Exhibit Defendants' Fly-wheel Governor."

(Defendants' counsel objects to the question for the reason that it is manifestly improper, not being in rebuttal, and being matter which strictly pertains to the question of infringement, and therefore should have been presented in the *prima facie* case.)

85 A. I can see no substantial difference between the invention and the claim in question in the Ide patent and the exhibit before me, showing the defendants' fly-wheel governor. The governing mechanism, the dash pot and the fly-wheel, is the same as that shown by drawings and described in specification and claim of the Ide patent. The result and purpose would, in my opinion,

be the same in both cases, as the interposition of a spring between the weight lever and the dash-pot piston on the Ball governor, the said spring being of the general dimensions in practical use, as shown on the exhibit, would not change the action of the governor in any way from the action produced by the Ide invention and was apparently introduced for the sole purpose of evading the invention and combination of the Ide claim.

Q. 66. Would the spring which you saw as a part of the Ball dash-pot piston rod on the 17th inst. and which appears in the "Exhibit Defendants' Full-sized Dash Pot" be compressed or elongated or have the slightest yielding motion under any conditions or practical operation?

A. I am positive that the spring shown in the "Exhibit Defendants' Full-sized Dash Pot" and the Ball engines examined by me on the 17th inst. could have no such action or movement whatever.

Recess.

Cross-examination by J. K. HALLOCK:

X Q. 1. At what time did you say you began as superintendent at the Hartford Engineering Company's works, in Hartford, Conn.?

86 A. On September 25th, 1882.

X Q. 2. Were you previously employed there?

A. Not by the Hartford Engineering Company, but I was employed in the same buildings and on the same property for a number of years by what was then called the Woodruff & Beach iron works.

X Q. 3. When was the Hartford Engineering Company established?

A. Their organization, to the best of my knowledge, was perfected about the year 1880.

X Q. 4. There was a time, then, between 1880 and 1882 when you were not employed there?

A. There was.

X Q. 5. At what time did you cease to be employed by that company as superintendent?

A. On June 18, 1884.

X Q. 6. During the time you were employed as superintendent there were you familiar with the engines on the market made by the leading manufacturers?

A. I was.

X Q. 7. You were acquainted then with such engines as are known to the trade as the Armington & Sims engine, the Paine & Sons automatic engine, Prof. Sweet's straight-line engine, were you not?

A. I was.

X Q. 8. Did not all of these engines I have just named come under the class or type called self-contained center-crank engines?

A. At that time the term "self-contained" had not been in general use signifying the type of engine, but they were usually called

high-speed engines, and I believe most of those named had center cranks.

87 X Q. 9. These engines had a balance wheel or fly-wheel at each end of the crank shaft substantially the same as shown in the cut of the Ball engine on the first page of "Defendants' Exhibit F," and were adapted to belt from either wheel or bolt as desired, had they not?

A. At the time in question not all of the engines named can be compared as fairly representing the style of engine shown in the cut, as some of them used a large driving wheel or wheels in which the governing device was not placed.

X Q. 10. Before 1884 the Armington & Sims engine was made and in common use, and it had a wheel at each end of its shaft from which a belt could be run, both of which wheels served also as fly-wheels. Is not that so?

A. Most of Armington & Sims' engines at that time were made as described in the question, but the engines having cylinders from 15 to 18 inches in diameter or thereabouts, with strokes something about 30 inches, were made with one shaft only, and that placed on one side of the engine, and on that shaft was placed a fly-wheel pulley or pulleys.

X Q. 11. Paine & Sons, of Elmira, then of Corning, N. Y., also made some engines, did they not, which had a center crank and a belt pulley at each end of the shaft, both of which pulleys also served as fly-wheels prior to 1884?

A. My first recollections of the Paine engines as I saw them exhibited for sale in New York, if my memory serves me right, were not center-crank engines; but I know that since that time they have made center-crank engines, and am quite sure I saw one somewhere about the time mentioned in the question which had a pulley on either end of the shaft, but only one of these, to the best of my recollection, served as a fly-wheel.

88 X Q. 12. The Prof. Sweet straight-line engine, as you knew it prior to 1884, also had a center crank, a shaft, and two belt pulleys, both of which pulleys also served as a fly-wheel?

A. I have been at Prof. Sweet's establishment several times during the last few years. He began a design of his engine with a center crank; at the same time he always used two belt wheels, but in the first designs one of these served as a fly-wheel pulley, carrying a belt also, while the other was used only as a power pulley and was not intended as a fly-wheel, and since then he has used two fly-wheel pulleys.

X Q. 13. He used two belt-pulley fly-wheels or two fly-wheel belt pulleys on his engine before 1884, did he not?

A. I think he did.

X Q. 14. In all of these engines having two pulley fly-wheels that were made by parties we have named prior to 1884 there was a governor of the type known generally as a shaft governor, which was placed in one or the other of these wheels, was there not?

A. No, sir; there was not.

X Q. 15. Do you wish to say that neither Armington & Sims nor

Paine & Sons nor Prof. Sweet prior to 1884 did not make and sell a steam-engine having two pulley wheels, both of which served as fly-wheels, and in one or the other of which wheels there was a governor which operated upon the eccentric to shift the same, which type of governor is sometimes called a shaft governor, sometimes a wheel governor, and sometimes a shifting eccentric governor?

A. I wish to say in answer, and shall try to make myself understood, that all of the builders named in their earliest productions of engines——

89 (Counsel for defendant- interrupts the witness and says to him that he is not inquiring about early production; that the question is categorical, to a direct point as to whether the manufacturers named did not, prior to a given date, make engines having the features named in the question, and a categorical answer is requested.

Complainant's counsel states that as he understands the rule the witness is not obligated to answer a question simply yes or no, but may qualify or explain any answer he may make if he deems this necessary to complete a full and fair answer.

Defendants' counsel says he will not object to any qualifying matter which may follow an answer to the question, but he does not want the record lumbered up with the junk piles of these manufacturers or any ancient history about their early productions.)

A. —used both large and heavy and small and light pulleys on the same engine, but to the best of my recollection Paine & Sons did not use two pulleys of the same size and of the same weight, properly called fly-wheel pulleys, prior to 1884, but that Armington & Sims and Prof. Sweet did use such pulleys, and that one of these pulleys contained the governing device which was connected with the valve motion of the engine.

X Q. 16. Then it is true, is it not, that A. L. Ide, the complainant, was not the original and first inventor of a fly-wheel governor?

A. So far in this case I have never understood that Mr. Ide claimed to be the inventor or originator of a fly-wheel governor; at least I have never been so informed.

X Q. 17. Well, you have not answered my question.

90 A. What language can I use to answer it than that that I have used?

X Q. 18. Was or was not Mr. Ide, the complainant, the first inventor of a fly-wheel governor?

A. He was not the originator of the fly-wheel governor.

X Q. 19. What other office or function does a shaft governor perform when in a fly-wheel that it does not perform when in a belt pulley, which is not, strictly speaking, a fly-wheel, as you have defined the difference between a belt pulley and a fly-wheel in your examination-in-chief?

A. It performs the office or functions of regulation to a certain degree, whether placed in a light belt pulley or wheel or a fly-wheel, but when it is located in a fly-wheel or fly-wheel pulley it performs the office of holding in perfect alignment the moving parts of the

governing mechanisms and enables the builder to materially reduce the weights of all these parts, thus reducing the inertia and largely the friction, prevents undue action from gravitation, thus rendering the whole mechanism much more effective in its operation as to alertness and accuracy, all of which good qualities cannot be obtained where the mechanism is placed in a light and small and unstable structure.

X Q. 20. All these advantages you have named were appreciated and understood by such builders as Armington & Sims, Prof. Sweet prior to 1884, were they not?

A. They were not, in my opinion, appreciated by any of the well-known builders until within the last three or four years, and this appreciation was brought about by the demands of the electric-lighting systems, and I am positive that all of these builders have enlarged the fly-wheel pulleys or fly-wheels in which their governing mechanisms are placed since the year 1885.

91 X Q. 21. Were you made aware of the application of the dash pot to the Hartford Carpet Company's engine prior to 1884?

A. I was.

X Q. 22. You have stated in your examination-in-chief that the dash pot was applied to the governors of those engines for the purpose of preventing "racing." Will you please state what racing is?

A. The term racing, as generally spoken of in relation to steam-engines—it is said that the governors race; this interpreted means that the chief parts of the mechanism which are actuated or controlled by the two forces centripetal and centrifugal are from some cause or influence in or about the whole machine that is in motion *is* lost control of for the time being, and instead of being the proper equipoise the weights go to their extremities and the springs to theirs or nearly so, causing the engine or fly-wheel or pulley wheel to have an irregular and unsteady speed.

X Q. 23. Would not this be a good short definition of racing as understood by mechanical engineers, viz., "wide and sudden radial movements of the weights"?

A. That would cover a portion of the ground, but I stated the influences which cause the wide range for oscillation in order to be explicit.

X Q. 24. Then, leaving out of consideration the causes of racing, the visible effect is wide and sudden radial movements of the weights, is it not?

A. The radial movements are generally sudden in those cases, but the width of range varies largely.

92 X Q. 25. When this undue radial movement of the weights is prevented the governor will have a steady and efficient action at all speeds within proper limit, will it not?

A. It will if the governor is not by malconstruction or design sluggish in its action.

X Q. 26. The dash pots were applied to the Hartford Carpet Company engine, you have stated in your examination-in-chief, to pre-

vent this racing, and you have stated that the racing in those governors was caused in part by undue friction on the cut-off valve stem, which is one of the reciprocating parts of the engine. Am I not correct?

A. The racing on these engines occurred from several causes, but the cause mentioned in the question was one of the chief defects in the construction; the friction caused by this cut-off valve stem, which was pressed compactly in the stuffing box by the packing, added to the inertia of one of the chief moving parts of the valve gear which was directly connected to the governing mechanism; in other words, I estimated that in any of these cut off valve stems and in those in question the friction amounted or was equal to a weight of the same weight of the cut-off eccentric rod, so that in reality the governor had to start or put in motion two cut-off eccentric rods instead of one. This weight of course was one of the chief disturbing forces in these engines and undoubtedly was largely responsible for the racing, but I will add that the Buckeye governors on these engines were constructed within a small scope as to diameter, the weights being very near the center of the shaft, and consequently they were very large. Now, this design added greatly to the inertia to be overcome while gravity figured largely as a deserving element as these heavy weights passed from their vertical to horizontal positions in their revolution; all of the above-
93 named disturbances were mostly due to a bad design for this class of governor, and the results could have been no other than those reached when the engines were first started.

X Q. 27. You have said in your examination-in-chief, have you not, that it was at the suggestion of Mr. Steel, one of the defendants' witnesses, that the dash pots were applied to those engines, and that the result was a satisfactory correction of the difficulty?

A. I did say that the dash pots on those engines was applied on the suggestion of Mr. Wm. Steel, the chief engineer of the carpet company, after the Buckeye Engine Company had failed to correct in any degree the errors in the governors or the racing of the engines, and that the results obtained by the use of the dash pots was satisfactory to the Hartford Carpet Company.

X Q. 28. And you have said, I believe, that afterwards dash pots were applied to the engines of the Hartford Manilla Company by the Hartford Engineering Company, while you were still with them, for the purpose of correcting a similar difficulty to that which had existed in the Hartford Carpet Company's engine. Am I right?

A. But one dash pot was applied at the Hartford Manilla Company, as there was but one engine, and that corrected the errors to such an extent that the engineering company got a settlement of their money claim, although in neither case of these engines the regulation was anything like the perfection reached by other builders since that time.

X Q. 29. Then, as I understand it, the Hartford Engineering Company and you, as a superintendent, had learned and understood the art of preventing a governor from racing where it is sub-
94 jected to undue extraneous influences, such as undue friction

and inertia and the effects of gravity, before 1884 by the application of a dash pot to the relatively movable parts of the governor?

A. I cannot say how much the Hartford Engineering Company as a company were instructed by the application of the dash pots to the governors of the engines of the Hartford Carpet Company and the Hartford Manilla Company, but I know that I was personally aware of there having been oil dash pots applied to the fly-ball governors of the engines built by Woodruff & Beach, George H. Corliss, Thurston & Gardner, and other Eastern builders twenty years before these were applied to the engines at the Hartford Carpet Company and the Hartford Manilla Company, and when the air was excluded from the dash pots built by Woodruff & Beach, thus preventing elasticity of movement in the dash pot, there was no trouble in getting nearly-perfect regulation.

X Q. 30. Then you at least, prior to 1884, understood the art of which I enquired in the previous question?

A. I did so far as it applied to the pendulum or fly-ball governor as attached to automatic cut-off engines.

X Q. 31. Did you not also understand it as applied to *to* such governors as were on the Hartford Carpet Company's engine and the Hartford Manilla Company's engine, which were shaft governors?

A. Although I had been perfectly familiar with the Buckeye or J. W. Thompson governor or cut-off since the year 1876, when one of their first engines was placed in the Centennial Exhibition in Philadelphia, it never occurred to me as being practical to apply an oil dash pot to a shaft or a fly-wheel governor for the reason
95 that I believed that it would be next to impossible to have perfect action from the dash pot, owing, as I thought, to the liability of neutralizing the effect by the action of the centrifugal forces on the moving parts of the dash pot and by what I supposed would be a continuous loss of the fluid by its being thrown from the dash pot by the revolution of the governor, and I was not satisfied as to the result until it had been placed on the engines in question.

X Q. 32. When it was placed on the engines in question and operated satisfactorily it was proved to you, and you then was aware that dash pots could be applied to wheel governors for the purpose of remedying the defects named in my question 29?

A. I had then found that a dash pot was useful in correcting the errors of a governor badly designed, like the Buckeye governor, but at that time had no opportunity of knowing how it would act on the other governors.

X Q. 33. If at that time, say right after it was applied to the manilla company engine and worked so satisfactorily that the engine was paid for and the matter was fresh in your mind—let us suppose that you would have been called upon as a consulting engineer to remedy racing in the governor of an Armington & Sims engine, which you have said have thereon a fly-wheel governor, and you had found that the racing was caused by the undue influence of extraneous forces, such as undue friction of reciprocating parts and

inertia and gravity or either of them, would you not have advised the application of the dash pot to the relatively movable part of the governor?

(Objected to by complainant's counsel as indefinite and incompetent.)

96 A. If I had been called to examine an engine of the build named in the question and I had found that inherent in its design and construction that it contained the elements of continuous disturbance to its governing mechanism, I should have at first endeavored to remedy the evil by a change of the parts or position of the principal parts of the governing mechanism, and if I had not accomplished the desired object, knowing what had been done with the dash pot in the two cases cited in the question, I should have probably made the application of a dash pot to this fly-wheel governor and should have considered in its application and combination to and with a fly-wheel governor that I had invented an improvement and applied for letters patent on a fly-wheel governor, which patent would consist of the fly-wheel in combination with the governing mechanism, with a dash pot attached.

Adjourned until Saturday a. m., 8 o'clock, July 21, 1888.

SATURDAY A. M., 8 O'CLOCK, *July* 21, 1888.

Met pursuant to adjournment.
Present: Same as before.

X Q. 34. Will you please take the Ide patent No. 201,720 and name the parts shown in figure 1 which are, strictly speaking, instrumental in the government of the engine, exclusive of the dash pot; name the parts by letter, as they are designated on the drawing?

A. As I understand the question, I am to consider in investigating the drawing accompanying the Ide patent simply the governing mechanism, exclusive of the dash pots and its attachments——

(Counsel, interrupted, says: Name no other part than those
97 which work together to govern the engine; such parts as would be there if there was no governor you will please not mention.)

A. Continuing my answer, I find on investigating the drawing and specification of the Ide patent that the parts shown and described therein as forming the governing mechanism are, first, the fly-wheel pulley lettered A on the rim, *a* on the arms, A at the hub; the two weight levers marked E, also e′ on one end; the connecting rod G. E′ represents the weights, the pins g′ connecting the two weight levers through the connection G, the coiled springs F, the pins *e*, which are the fulcrums on which the weight levers oscillate, said pins being fastened to the arms of the fly-wheel pulley, thus completing one of the principal bases of motion, and resistance to the opposing forces of the governing mechanism; the swinging pendulum arm marked D, and its fulcrum pin *d*, with

and inertia and the effects of gravity, before 1884 by the application of a dash pot to the relatively movable parts of the governor?

A. I cannot say how much the Hartford Engineering Company as a company were instructed by the application of the dash pots to the governors of the engines of the Hartford Carpet Company and the Hartford Manilla Company, but I know that I was personally aware of there having been oil dash pots applied to the fly-ball governors of the engines built by Woodruff & Beach, George H. Corliss, Thurston & Gardner, and other Eastern builders twenty years before these were applied to the engines at the Hartford Carpet Company and the Hartford Manilla Company, and when the air was excluded from the dash pots built by Woodruff & Beach, thus preventing elasticity of movement in the dash pot, there was no trouble in getting nearly perfect regulation.

X Q. 30. Then you at least, prior to 1884, understood the art of which I enquired in the previous question?

A. I did so far as it applied to the pendulum or fly-ball governor as attached to automatic cut-off engines.

X Q. 31. Did you not also understand it as applied to *to* such governors as were on the Hartford Carpet Company's engine and the Hartford Manilla Company's engine, which were shaft governors?

A. Although I had been perfectly familiar with the Buckeye or J. W. Thompson governor or cut-off since the year 1876, when one of their first engines was placed in the Centennial Exhibition in Philadelphia, it never occurred to me as being practical to apply an oil dash pot to a shaft or a fly-wheel governor for the reason
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X Q. 33. If at that time, say right after it was applied to the manilla company engine and worked so satisfactorily that the engine was paid for and the matter was fresh in your mind—let us suppose that you would have been called upon as a consulting engineer to remedy racing in the governor of an Armington & Sims engine, which you have said have thereon a fly-wheel governor, and you had found that the racing was caused by the undue influence of extraneous forces, such as undue friction of reciprocating parts and

inertia and gravity or either of them, would you not have advised the application of the dash pot to the relatively movable part of the governor?

(Objected to by complainant's counsel as indefinite and incompetent.)

96 A. If I had been called to examine an engine of the build named in the question and I had found that inherent in its design and construction that it contained the elements of continuous disturbance to its governing mechanism, I should have at first endeavored to remedy the evil by a change of the parts or position of the principal parts of the governing mechanism, and if I had not accomplished the desired object, knowing what had been done with the dash pot in the two cases cited in the question, I should have probably made the application of a dash pot to this fly-wheel governor and should have considered in its application and combination to and with a fly-wheel governor that I had invented an improvement and applied for letters patent on a fly-wheel governor, which patent would consist of the fly-wheel in combination with the governing mechanism, with a dash pot attached.

Adjourned until Saturday a. m., 8 o'clock, July 21, 1888.

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Met pursuant to adjournment.
Present: Same as before.

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the continuation of this arm, the lower end of which is in the form of an eccentric strap, this lower end being connected to the weighted levers E through the medium of the connection G, the fastenings of the springs at each end not marked by letters in the patent. I believe that this includes all the parts called for in the question.

X Q. 35. Please point out in the specification where it is that the fly-wheel A is described or mentioned as forming part of the governing mechanism.

A. I find in carefully reading the specifications of the Ide patent that the inventor starts out with the statement that his invention "relates to that class of steam-engine governors known as fly-wheel governors, and has for its primary object to provide means for holding the eccentric steadily in its proper poised position in opposition to the tendency of certain extraneous forces which are calculated to disturb the movements of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion." He also describes this fly-wheel as a part of his governing device and says the part marked "A is a pulley or wheel, having arms *a a*, and secured to its central hub to the shaft B," line 89, first page, and he continues in line 91 and says that "D is an arm attached to the eccentric and supporting it from the body of the pulley by a pivot pin at *d*;" continuing, at line 97, page 1, he says: "E E are two upright levers fulcrum- at *e e* to opposite points on the pulley A, and E′ E′ are the weights applied adjustably as to their position to said levers. The weight levers project in opposite directions from their pivotal points, so that the weights E′ thereon, when properly located, stand at diametrically opposite points of pulley and counterbalance each other." Again, on line fourteen, page 2, he continues and says: "Near the free extremities of the levers E E, and at points equally distant from their fulcrum, coiled springs F F are connected therewith and the opposite end- of said springs are attached to suitable points on the pulley." Besides giving these quotations from specifications I will say that the drawings and claim alone would be sufficient to any mechanic to show him the objects sought for by the inventor and to enable him to construct the machinery of this invention in conformity with the ideas and aims of the inventor as laid down and described in his drawings, specification, and claim.

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X Q. 35½. You have evidently misunderstood my question. Had I asked you to point out in this specification references to the fly-wheel and the manner of erecting governor therein your answer would be pertinent, but I did not so inquire. I will repeat the question in substance. You have stated in your last answer as follows: "He also describes this fly-wheel as a part of his governing device." Now, please state on what line and page there is a description or statement saying that the fly-wheel is part of the governing mechanism.

99

A. In all the quotations from pages one and two of the Ide patent, and the drawings conclusively confirm these quotations, I as an engineer can see that the inventor introduced or intended the fly-wheel to be a part of the governing mechanism delineated and

described by him, and his claim emphatically substantiates my conclusions and I cannot make this any plainer by any explanation that I can now call to mind.

X Q. 36. You are unable, then, to point to any part of the specification which refers to the fly-wheel as part of the governing mechanism and describes its office?

A. I have pointed out in several lines in the specifications of the Ide patent where the fly-wheel is described as not only a part but a very important part of the governing mechanism, and these lines in the specification describe the office of the fly-wheel in this connection, and I will once more add that the drawings accompanying this patent specification, which are a part and parcel of the letters patent, show in the most conclusive manner that the fly-wheel is the principal structural base for the resistance and for holding in action the well-known forces at work in this class of governor.

X Q. 37. That's what you mean, then; you mean that the fly-wheel is part of the governing mechanism because it is the
100 structural base on which the governing mechanism is erected, and that its office as part of the governing mechanism is that of a support or base; am I right?

A. The fly-wheel is a support for and a part of the other portions and details of the governing mechanism and, as I have previously stated, it performs the office as a structural support as a part and detail to hold and carry all the forces in action, and in playing this part the geometrical points of suspension, support, movement, which are an integral part of the fly-wheel are performing their functions with the same geometrical precision, with the same resistance to forces, with the same degree of mechanical action in movement as any of its neighboring details—in other words, it has as much share of the governing duty as the centrifugal weight levers or the springs that resist centrifugal force and as a moving structure; by the very philosophy of its action, by its being a reservoir for regularity of action, it imparts a regularity of movement to the other parts of the governing mechanism of which it is a member, and this result cannot be obtained by a small, light disk or pulley, or by any other device except what can be strictly termed a fly-wheel or fly-wheel pulley.

X Q. 38. Now, please look at the drawing again of the Ide patent and point out by the designating letter of reference all the parts which are mounted on the shaft which would be essential to the proper running of the engine if there was no governing mechanism there at all.

A. It will depend, according to your question, on what this engine, entirely stripped, as you describe, of its governing mechanism, as I note the drawing accompanying the Ide patent, because it would then contain nothing but the shaft marked B in sec-
101 tion and in sectional plan, and would therefore leave the engine practically without a reservoir of momentum or any steadying device, thus making its rotative motion so unsteady as to be practically of little or no use in transmitting power.

X Q. 39. Do you wish, as a mechanical expert, to go on record

with that answer to that question, to say nothing of being a Christian gentleman under oath?

A. I wish to say that my answer conforms strictly with your question in every particular, inasmuch as you directed me to formulate my answer after examining the drawings accompanying the specifications and claim of the Ide patent and which I now hold in my hand, and as a Christian gentleman I am positive that I have told nothing but the truth in my answer.

X Q. 40. My question is perfectly plain. It is in substance this: Supposing we have an engine of the type partially representing the Ide patent drawings, which is governed, say, by a throttle governor and not by a wheel or shaft governor, then, of course, there would be no governing mechanism in the fly-wheel. Now, what parts represented in Fig. 1 would be essential to such an engine, or, in other words, what parts represented in this drawing would be omitted? Please answer this question by designating the parts and without any circumlocutory dissertations.

A. As you have called my attention again to the drawings accompanying the Ide patent, I will say that the title on those drawings which designates what these drawings show reads that it is a "steam-engine governor" and does not say that it is a steam-engine, and it shows and describes that every line shown on that drawing is a part and parcel of that governor, with the exception of the
102 part marked B in section in plan and elevation, and this portion is said to be in the specification a shaft and is no doubt intended to be a shaft of a steam-engine, but further than that we could not construct a steam-engine in mind or in fact from the line of this drawing, as it represents specially the governor for a steam-engine.

X Q. 41. Well, if you want to crawl out of answering my question in that way I am perfectly willing to let you do it, and I will ask you another question. You admitted yesterday that Mr. Ide was not the inventor of a fly-wheel governor; that there was a class of governors known as fly-wheel governors before he made his invention. Is not that fact also admitted in the specification of the Ide patent, which says that "this invention relates to that class of steam-engine governors known as fly-wheel governors"?

(Complainant's counsel objects to the personality of the prelude of this question, if for no other reason than simply as a question of taste.)

A. I stated in my cross-examination yesterday that there was governing mechanisms placed in fly-wheels prior to Mr. Ide's invention, and, as you refer me to the specifications once more, I will call your attention to these specifications, beginning on page 1, at the first line, and ending on the thirteenth line, and as I have thoroughly read this, together with his claim, which will be found on lines 68, 69, and 70, I believe that these lines fully support Mr. Ide's intents and purposes in regard to his patent in relation to a steam-engine governor.

X Q. 42. An answer to the question is demanded.

A. I have tried to answer fully in the answer just given,
103 but I will add that Mr. Ide has stated in his patent that governing mechanisms were placed in fly-wheels before his patent was issued?

X Q. 43. And you admitted yesterday that dash pots had been used in shaft governors for the same purpose as is described in the specification of the Ide patent in the following language, beginning on line 14, page 1, "and has for its primary object to provide means for holding the eccentric steadily in its proper poised position in opposition to the tendency of certain extraneous forces, which are calculated to disturb the movements of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion;" and further on in the specification, beginning on line twenty-nine, page 1, these disturbing forces are defined as follows: "There are, however, certain temporarily acting causes of disturbance calculated to change the position of the eccentric independently of the speed of the wheel. The principal of these disturbing causes is the inertia of the reciprocating parts, including the eccentric and the parts actuated thereby, and a secondary cause is the gravity of the eccentric when not counterbalanced by some special device for the purpose." Did you not, when you stated that the disturbing forces in the Hartford Carpet Company's engine governor resulted from undue friction on the cut-off valve stem, and the inertia of the reciprocating parts and the undue weight of the fly-balls, making them too sensitive to gravity?

A. I recollect making no such admission as you refer to in the quotations of the Ide patent. I did state, however, that the governors as applied to the Hartford Carpet Company's engines were
104 in the form of a disk, and the design of this disk was so small in its proportions and the weights so heavy in proportion to the size of the disk, together with the design of the cut-off valve stem and its stuffing box, and also the useless inertia in the reciprocating parts was so faulty in general arrangement that the engines were in danger of wreckage as well as the machinery in the mill from the unsatisfactory regulating qualities of these governors. I said that Mr. Wm. Steel, on his own ideas, constructed a dash pot, which he placed in the governor, and by its use so controlled the heretofore uncontrollable forces, and thus was able to run the engines and the machinery driven without serious damage to either, and upon the accomplishment of this result a threatened suit for damages was avoided and a settlement was made between the two parties concerned. When I said that a satisfactory result was reached, I meant it was satisfactory for running that class of machinery for ordinary mill-work, but the governors of these engines as constructed, even after the dash pot was applied, were not in any sense perfect in their regulation, for they were not suitable to run those engines or any others for any kind of electric-lighting purposes. My reasons for so stating this are that the size of the disk would not allow of the proper construction and arrangement of the governing mechanism—first, the dash pot could not be placed radially to the center of the shaft, but would have to lie across and

did lie across the shaft, thus bringing the dash-pot piston rod, piston, and cylinder and their attachments directly under the influence of centrifugal force, thus causing friction on all moving parts connected with it, thereby neutralizing the objects sought for in its use; as the dash-pot cylinder and piston rod was not in a radial line with the center of the shaft, as shown in the cuts of the Ide governor, it could not be run
105 with proper results on a high-speed engine for these reasons: that the friction would be largely increased on its moving parts, the air could not be readily excluded, as is the case in the arrangement shown in the Ide patent, while the glycerine or oil used in the dash pot would be and is rapidly thrown from dash pots arranged as those were on the Hartford Carpet Company's engines if used on engines for electric lighting, while in the case of the Ide arrangement of dash pot the centrifugal force has no tendency to throw the oil or glycerine from the dash pot, because the stuffing box points in the direction of the center of the shaft; in a word, a large fly-wheel admits of governing mechanisms with dash pots attached in their very best forms and designs for efficiency, while the small disk or casing or pulley will not, under any circumstances, permit of such an arrangement.

X Q. 44. And you said yesterday, did you not, in answer to X Q. 33, in substance, that prior to 1884 you had sufficient knowledge of the use of dash pots for steadying the movement in shaft governors so that if you had had an Armington & Sims engine which has a fly-wheel governor thereon that was unsteady in its motion, which you could not correct in any other way, you would have applied thereto a dash pot, and you further said, did you not, that in case you had done so you would have applied for a patent therefor?

A. I said that probably after attempting to correct the errors of the governing mechanism in an engine in which this mechanism was placed in a fly-wheel, knowing what had been done in a small disk governor, I should have applied for letters patent on the combination of a governing mechanism consisting of a fly-wheel,
106 a governor, which would be part of the same, and a dash pot, if I had found a successful result in my experiments in the use of the dash pots with the fly-wheel and governor combined.

X Q. 45. What invention would you have made on which you could have reasonably asked for a patent, the fly-wheel governor not being your invention and the use of the dash pot to steady governors of that type—to wit, a wheel governor—having been taught you by the successful experiments of Mr. Wm. Steel?

A. My grounds for applying for a patent would have been based on the combination of the fly-wheel with the rest of its governing mechanism and a dash pot, and my reasons for asking for letters patent would have been principally as follows: First, that it was found with the small disk in which the governing mechanism with its dash pot was applied on the Hartford Carpet Company's engines would not allow of a proper arrangement of the details, levers, weights, dash pots, etc., so that it was impossible to obtain anything like perfect regulation, and by using a fly-wheel, which is usually

from four to five times in diameter the length of the stroke of the engine, I would have seen at once that I had the means at hand for placing my weights and levers further from the center of motion or center of the shaft, lightened the weights in consequence, increased my leverage on the weight levers, thus at once reducing the inertia and the effects of undue gravity, and in making the combination of the dash pot it gave me the much-desired opportunity of attaching the piston-rod to the ends of the weight levers, thereby giving the advantage of leverage to the dash pot, thus enabling me to reduce the diameter of the dash pot and its piston, thereby largely reducing the friction at this point and also
107 the weight of the dash pots; it also gives me the opportunity of having a longer travel or stroke to the dash-pot piston, which in its vantage of leverage adds greatly to the controlling qualities of the same by the use of the fly-wheel as a part of this governing device; the dash pot can be placed and is placed on a radial line with the arms of a fly-wheel, with its stuffing box, and next to the center of the shaft and close to the same. This arrangement of the dash pot with its piston and rod is one of the most important features in this combination invention. By such an arrangement we are entirely free from any frictional resistance that spring- from centrifugal forces, as the center of our dash-pot piston and rod are in a direct line and move in a direct line (in their natural course of work) with these forces, so that we are absolutely free from a defect that proved to be fatal to the perfect regulation of the Hartford engines, for it was demonstrated beyond a question that the frictional resistance caused by the centrifugal force pressing the dash-pot piston and piston rod was very great, and prevented the accomplishment of perfect regulation, but this could not be remedied in that class of governor. Next, the next ground for an application for a patent would have been that in my personal experience with governors of the type like that of the engines of the Hartford Carpet Company I had found that the disks or casings were necessarily so inadequate as to diameter and strength that it was impossible to revolve them with the usual overhanging appurtenances and attachments of a governor of this type without springing the structure of the disk and thereby bringing undue strains and friction on the pins and journals to such a degree that the alignment of the
108 connections and levers were very seriously affected and in some cases destroyed to such an extent that the governor failed to perform its functions; again, another ground for a claim for invention would have been the application or location of this combination of fly-wheel governor and dash pot as a unit structure, forming as a whole, and a great improvement over any device ever used before for the purpose set forth in the specifications and claim identifying the invention. In specifying the advantages I should state that another point not to be overlooked is that this combination, fly-wheel governor and dash pot, by its natural arrangement in connection with the valve gear is located immediately next to the main bearing of the engine shaft, where it becomes, by reason of its weight, an absorbant or a receptacle of the initial shocks at each end

of the stroke caused by the entering steam, and by thus absorbing this initial force or pressure the boxes and journal of the main shaft are wonderfully relieved from this pressure, and consequently the friction of the engine is reduced at this point from 12 to 15 per cent. Then, again, the combination of fly-wheel governor and dash pot enables us to bring the whole device within the reach of the automatic oiling arrangements which are usually placed on or near the main bearing of the engine and which can readily supply the oil for the crank pin, main bearing, and the governing mechanism complete.

X Q. 46. In other words, then, as I understand your answer, you would be entitled to claim as your invention all the advantages of the Armington & Sims construction by reason of your having put into that construction a dash pot, for, as I understand it, the Armington & Sims construction has a fly-wheel governor—that
109 is, a governor placed in a fly-wheel and that fly-wheel placed next to the bearing of the engine. Do I understand you correctly? Or, again to illustrate, your idea would be that a person putting a ventilator which was common on houses, not having the modern improvements therein, would be entitled to a patent on all the modern improvements in a house by putting a ventilator onto a house having those improvements therein?

A. I should claim an invention which would consist of the combinations that I have explicitly enumerated and described in my last answer to you, and for the reasons there given in detail, and I am not aware that the particular firm, Armington & Sims, were the first to apply a governing mechanism or insert the same in a fly-wheel or fly-wheel pulley of an engine and then locate the fly-wheel close to the main bearing of the engine. I cannot follow your comparison, as I do not consider myself an expert in house ventilation.

X Q. 47. You have said that one of the advantages that you would claim in this hypothetical patent would be that you were able to so place the dash pot so that the stuffing box would lie nearest the center and thereby prevent the escape of oil or glycerine from it by centrifugal force. You would then have more nearly followed the construction shown in "Defendants' Exhibit- A" and B" than that shown in the Ide patent, would you not?

Adjourned to Monday, 10 o'clock a. m., July 23, 1888.

MONDAY, *July* 23, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.
Present: Same as before.

A. I have examined the drawings accompanying "Defend-
110 ants' Exhibit A" and know that the design was not carried out in practice in either case precisely. For instance, in the drawing of the Ide patent the draughtsman appears to have turned the stuffing box towards the fly-wheel-rim portion of the governor, while, as a matter of fact, there was never an Ide governor made in

that manner, but was made as shown in the model, with the stuffing box towards the center of the wheel. I will now compare Exhibit "A" of defendants, which I assume was merely a design sketch showing a proposed application of dash pot. As a matter of fact, no dash pots of this real design and location were ever applied to a Hartford engine. The dash pot in both cases of the Hartford Carpet Company and the Hartford Manilla Company could not be placed in the position shown on the drawing owing to the small diameter of the governor discs, but were really further from the center of motion or center of shaft and placed towards the outside of the discs, thus increasing the centrifugal tendency to throw oil more than that of the design shown by the drawing of the Ide patent. In consequence of the actual arrangement on the Hartford Carpet Company and Hartford Manilla Company the dash pots had to be made very much shorter and very much larger in diameter than that shown on the drawing of the "Defendants' Exhibit A."

X Q. 48. You have evidently misunderstood the subject inquired of in the last interrogatory. I did not inquire in regard to the Hartford Carpet Company's engine nor the manilla company's engine nor as to the way in which Ide had made his engine governors. I was inquiring about this hypothetical engine or governor which was to consist of an Armington & Sims fly-wheel governor, to which you, as a mechanical engineer, was applying a dash pot and
111 for which with the dash pot applied you were supposed to be applying for a patent, the grounds or claims of which application you stated in a former answer, among which claims were to be, as I understood you, one for the feature of placing the dash pot so that the stuffing box would lie nearer the shaft than the opposite end, and I ask, then, if your construction would not more nearly approach that shown in "Defendants' Exhibits A & B" in that one respect—namely, that the stuffing box of the dash pot would be nearer the shaft than the closed end of the dash pot—than does the construction shown in the Ide patent. Now, will you please answer the question?

A. I have in my hand "Defendants' Exhibit A," and will say that were I constructing this hypothetical engine, and were it possible (which it is not) to construct the mechanism as shown in Exhibit A, the location of the dash pot with reference to the point in question in this particular comparisom would give me an arrangement of dash pot which would permit a larger leakage of oil from centrifugal force than that if the hypothetical engine governor were constructed after the plan or design illustrated by the drawings accompanying the Ide patent for the reasons that, as I have stated many times before, the "Defendants' Exhibit A" has the dash pot placed across the plane of the shaft and not in radial lines, as is shown in the Ide patent drawing, so that the centrifugal action of the parts and details of the dash pot would throw the piston rod to one side of the stuffing box, leaving the other side open for a distance of fully half the distance of the circumference box, thus leaving a free channel through which the oil or glycerine would be thrown by centrifugal force or action. On the other hand, the design as shown in

112 the Ide patent drawing would give me the chance to place the piston rod, piston, and dash pot in a radial line, the piston rod's center being coincident with this radial line, and we thus have it entirely out of the line of centrifugal forces that otherwise might have a tendency to sway in its position in the stuffing box. In other words, the natural central laws of motion will keep the piston rod central as designed in the Ide patent paper. Again, it would be simply impossible to place a dash pot as near the main springs of the governor as that shown in "Defendants' Exhibit A," as it would be at once destroyed or wrecked by the swaying and vibration of those springs under centrifugal action. In practice I have seen the springs on like governors with that of "Exhibit A" sway and vibrate from an inch to an inch and a half. The drawings shows by a scale that the dash pot is within one-eighth of an inch of the spring.

X Q. 49. You are still talking about something I haven't asked about. Now, I will see if you can't get at it in another form. Please put your rule on the drawing, "Exhibit A," and tell me whether the dash pot and stuffing box in that drawing is nearer or farther from the shaft than the other end of the dash pot.

A. Yes; it is nearer.

X Q. 50. Now, look at the drawings of the Ide patent and tell me if the stuffing box is not farther from the shaft than the other end of the stuffing box.

A. I have examined and measured the "Defendants' Exhibit A"——

(Counsel interrupts and says there is not one word about "Defendants' Exhibit A." The question is, Is not the stuffing box in the Ide patent drawing farther from the shaft than the other end of the dash pot?)

113 A. I have measured the drawing of the Ide patent, and find the stuffing box is further from the shaft than the opposite end of the dash pot, but this position is preferable for a dash-pot stuffing box to that shown on "Defendants' Exhibit A" for the reasons that I have before stated.

X Q. 50½. Do you pretend to say as a mechanical engineer that a stuffing box arranged as shown in "Defendants' Exhibit A" would have oil or glycerine thrown from it by the centrifugal force generated by the revolution of the governor?

A. I do, and speak from practical knowledge, for the dash pots arranged in the manner shown by the "Exhibit A" are of a particularly bad design, because such dash pots, being hinged from the bottom, have a much greater tendency to distort the piston rod and piston from the true alignment with the cylinder and stuffing box, thus aggravating the leakage at the stuffing box, of course the cause being the centrifugal action of these parts, and the defendant is probably aware of the truth of my statement, as I note that his patent papers show the dash pot to be hinged at the bottom in the same manner as "Exhibit A" of defendant, while in practice and in his model he hangs the dash pot on a trunnion attached to the

center of the length of the cylinder, which greatly relieves the frictional tendencies of the piston, piston rod, stuffing box, etc.

X Q. 51. Look at Defendants' "Exhibit A" and tell me at which end of that dash pot the contained fluid will be found when the governor is in revolution.

A. In order to have action with the dash pot it must be full——

(Counsel interrupts: I ask an answer to this question without any further talk.)

114 A. But in either case, supposing it to be half full, as you suggest in your question, the centrifugal action will be such as to carry it towards the stuffing-box end, and the leakage would take place under that action.

X Q. 52. By what law of physics is it that the centrifugal force generated by the revolution of the governor will throw the matter contained in the dash pot towards the center of motion?

A. In speaking of centrifugal force in connection with this mechanism I have taken into consideration all the elements in action. We have the action of the centrifugal force of the levers and weights, and we have the action of the centrifugal force of all the details of the dash pot as suggested, and in combination with these forces, if we revolve the fly-wheel governor in one direction, the glycerine has a tendency to move to one end of the cylinder, and if we should change the direction of motion the oil would have a tendency to move in the opposite direction from that first mentioned. I notice by diagram in "Exhibit A" that the springs are not arranged across the plane in a horizontal line, as is done in practice with that class of governor or was done in the governors that I was familiar with, for in those one end of the spring was but little, if any, higher at one end than the other, and, as the dash pot would have been naturally placed parallel with the spring, it would be, when the weights stood perpendicular, about level.

X Q. 53. Did you ever put some water in a pail and swing it around over your head and not spill any of the water, by reason of the centrifugal force keeping the water in the pail?

A. I never tried that experiment personally, but I suppose
115 that you mean that a pail revolves in the radial direction of a fly-wheel or any other similar device; that the water would remain where the centrifugal force would naturally place it.

X Q. 54. Would it make any difference in the direction in which it would revolve?

A. If the pail was revolving with the bottom to the outward periphery of the circle, if the pail was placed with the bottom or closed end of the pail toward the periphery of the circle, the water would remain nearest to the bottom of the pail while it was in motion, but if the pail was placed in the position of the dash pot shown in "Defendants' Exhibit A" the water would have a tendency to leave the pail if it revolved in one direction and a tendency to remain in the pail if it moved in the other direction, provided the bottom was in the pail.

X Q. 55. How do you know that Ide has never made any engine

governors with the dash pot as shown in the drawings of his patent, with a stuffing box nearest the periphery of the wheel, as stated in one of your previous answers?

A. I know this, that I have seen several of the Ide engines, some of them between four and five years ago, and I never saw any with the dash pot arranged as shown in the position represented on the drawing accompanying the patent. I mean as far as relates to the position of the stuffing box.

X Q. 56. But that does not justify your answer. Did you speak from hearsay?

A. My last answer was based on my personal knowledge as far as I have seen within the past four or five years, but Mr. Ide told
116 me about two years ago that he had never built an engine with a stuffing box as shown in his patent drawing.

(Counsel thereupon objects to the former statement and to the statement just made on account of its being hearsay evidence.)

X Q. 57. I show you now letters patent number 308,498, issued to Mr. Ide, which is named in the bill of complaint in this case and which was applied for April 25, 1884, nearly a year after the other patent in suit was applied for, and I ask you to look at Fig. 1 and state whether the dash pot "H" shown therein is not placed with the stuffing box nearest the periphery of the wheel.

A. I have the patent paper of Nov. 25, 1884, in my hands, which is evidently copied, as far as the dash pot is concerned, from the original patent drawing, and shows the stuffing box in or about the same position relatively, but it shows the dash pot and stuffing box in a radial line, the same as in the first patent drawing accompanying the Ide patent.

X Q. 58. I now call your attention to the other patent, 301,720, and ask you to look at the claim. Supposing that claim read up to the first comma "in a wheel governor" in place of reading "in a fly-wheel governor," would you understand the claim then to have any other or different significance from what is has now?

A. If the claim as laid down should be changed in its phraseology to read as you have just suggested in your question, and the specifications and drawings bore out the test in its changed form, I should certainly say that it could have some other significance and would of necessity have some other significance than the claim of the Ide patent in suit as actually incorporated in the specifications No. 301,720.

117 X Q. 59. What change in the drawing would be necessary?

A. For example, if it were simply a wheel governor, or we will call it a disc governor, or we will go farther and call it a light pulley governor——

(Counsel interrupts: You have no right to assume anything further than the question, which is confined to a wheel governor.)

A. Continuing my answer, I will say that if we were to construct a pulley or wheel governor for the simple purpose of containing a

governor of this description it would not be in the nature of a fly-wheel, but would be reduced in diameter, in weight, and proportions, as each and every portion would be different from that in the combination of the fly-wheel governor and dash pot.

X Q. 60. Please look at "Defendants' Exhibit A" and tell me whether the main figure there represents a fragment of a wheel governor or a fly-wheel governor.

A. The blue print, "Defendants' Exhibit A," in my hands represents what is called by the inventor and was called by the Hartford Engine Company, who built it, and is what I designate a disc or shaft governor. I form my conclusions and make this statement, that these governors as represented by this blue print, "Defendants' Exhibit A," were formerly cast with a solid disc or plate joining the hub and the rim and were changed to an arm disc or casing by coring openings in the disc or plate, leaving arms to connect the hub and the rim, the object of the change being to leave openings for convenience in adjusting the governor. This casting was not suited for a pulley for power, because the arm or disc plates were cast very much to one side of the center of the narrow rim, said rim
118 only being made for the purpose of protection to the attendants of the engine.

X Q. 61. Isn't the governor represented in the "Defendants' Exhibit A" shown as in a wheel, which is about five feet five inches in diameter?

A. It is represented as being shown in a regular Buckeye governor casing and is a No. 6 governor, which means that it is designed to be used on an engine or engines having cylinders from twenty-four to twenty-six inches in diameter and with strokes from thirty-six to forty inches, the shaft of which is twelve and one-half inches in the journals and fifteen inches between journals, said engine calculated to develop non-condensive three hundred horse power and condensing three hundred and seventy-five horse power, fitted with a fly-wheel or fly-wheel pulley fourteen feet in diameter and weighing from ten to twelve tons, and therefore the blue print in question can only represent and does only represent the governor casing with the governor mechanism therein.

X Q. 62. Please give the dimensions of the wheels shown in "Defendant-' Exhibit A," which you call a governor casing, as to the thickness and width of the rim.

A. The thickness of the rim, according to the scale, is one inch, and, while the blue print does not show the width of this rim, I will state for your information that for this size of governor casing the rim would be about six and a half inches wide, perhaps 7, this thickness and width being necessary in a wheel of this diameter and with the diameter of hub on same in order to prevent overstraining in casting and to give a proportion of thickness to make it safe in handling the wheel in its manipulation in the shop. It is made in halves, as the drawing shows, and is clamped
119 to the shaft by two bolts, so that it can be adjusted when adjusting the valve motion, and has no key such as is always used in fly-wheels or fly-wheel pulleys and can have no key, as its

position must be shifted to suit different conditions in setting the valves.

X Q. 63. About what would be the size of an engine of the pattern shown on the first page of "Defendants' Exhibit F"? Would it be proper to use a belt pulley five feet five inches in diameter with a rim six and one-half or seven inches wide and one inch thick, or, in other words, on what size of engine of this pattern might such a pulley be used?

A. I first want to know the speed which this belt pulley will run.

X Q. 64. Let the speed be, for example, two hundred and seventy-five revolutions to the minute.

A. As I understand your question now the said pulley could be used to take off a certain amount of power according to its speed and width of belt, and said pulley could be placed on an engine of twenty-five horse power or an engine of four hundred horse power, but it would only transmit the amount of power due to the belt speed and the width of the same, but in any case if the speed of the pulley in case of applying it to a small engine was not sufficient it would be necessary to have a fly-wheel on the shaft with it or in connection with its own revolution on a shaft connected to it. If placed on the four hundred horse power it would only play the part of a transmitting-power pulley and a very insignificant part at that.

Adjourned to Tuesday, July 24, 1888, 10 o'clock a. m.

120 TUESDAY, *July* 24, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.

Present: Same as before.

Examination of Mr. HOFFMAN resumed:

X Q. 65. On what sized engine of the pattern inquired of in the last question might a wheel which is five feet five inches in diameter with a rim one inch thick and six and a half or seven inches wide and proportionately made be used as a fly-wheel and belt wheel combined, it being understood that on the other end of the shaft there is another wheel of the same dimensions? In other words, supposing an engine of the pattern shown in the cut to which I have referred you was provided with wheels at each end of the shaft, as there shown, of the size and dimensions I have just stated, what would be the proper size and dimensions of the cylinder proportioned relatively as the cylinder there shown? And you may assume in answering the question that the engine is intended to run at what is called high speed, say 275 revolutions per minute, and you may further assume that there is no governor in either of the wheels, but that the engine is governed by a throttle governor, and you may further assume, if you please, that the engine is to be used to drive two dynamo machines, one belted from each wheel. Now understand all I inquire of is what would be the size of such a cylinder in an engine.

A. I think I understand your question and will say that an engine having wheels as you have described or fly-wheel pulleys would

be rated from 30 to 35 horse power and would have a steam cylinder about eight inches in diameter and with a stroke from 9 to 10 inches—that is, provided the usual steam pressure, say 90 pounds, was used.

121 X Q. 66. Now, supposing that this engine was to be fitted up with a Buckeye governor, such as shown in "Defendants' Exhibit A," in one of the wheels to govern the engine with in place of the throttle governor, said governor having in its construction no dash-pot attachment, what change would be required in the construction of the pulley fly-wheels as to size, weight, or other dimensions?

A. I hold "Defendants' Exhibit A" in my hand, and in answer to your question will say that it would be impossible to put all parts of the disc or casing governor designated as number 6 in a fly-wheel pulley of the dimensions given in your previous question, because the disc or casing, which is one of the principal details of the governor, would have to occupy the space allotted to the said fly-wheel pulley, and that would be a mechanical impossibility and contradiction if we still attempted to retain the pulley. Another thing, the casing, as shown on number 6 governor——

(Counsel interrupts: I protest against the witness trifling with the time of the court in making such tom-fool answers as this. Any mechanic that knows a hammer from a buzz-saw would know that the question as intended can have no other interpretation than that the wheel inquired of was to be the case or support of the governor. In fact, this was explained orally to the witness, and to save time he was requested not to mention any mechanical changes which would be required, such as providing bosses, lugs, etc., for seats for the pivots of the governor, arms and attachments for the springs, and the witness is instructed that if he expects his testimony to have any weight with the court he should display intelligence enough to interpret a plain and fairly worded question.)

122 A. Continuing my answer after your interruption, I will say that the casing or disc as shown in "Defendants' Exhibit A" by blue print could not be used to transmit power, as they are not turned crowning to keep the belt in position, and that the projecting rim is not strong enough, being very much offset on the arms or web of the disc, these arms being too light and weak for fly-wheel-pulley purposes, and——

(Counsel interrupts again: If you would pay the slightest attention to my question you would know that I did not ask one word about the casing shown in "Exhibit A," but I ask what changes would be required as to dimensions of a pulley fly-wheel five and a half feet in diameter, with a rim one inch in thickness and six and a half or seven inches in width, placed on a steam-engine having a cylinder of 9 or 10 inches stroke and 8 inches in diameter, of the pattern shown in the cut you have in your hand, in order to adapt it to receive governing mechanism—that is, weights, weight arms, and springs, but no dash pot, said governor parts being such as are

commonly known as the Buckeye governor. Now, understand, you are not to say a word about that case shown in the drawing. Now please answer the question as restated.)

A. Continuing after your second interruption, I will say that, considering the fly-wheel or fly-wheel pulley, as you have put the question, as a part of the governor, I will answer you, in as few words as possible, that it would be necessary to meet the requirements in your question to so recast or reconstruct this fly-wheel pulley that it would receive the sustaining points and attachments of the parts of the Buckeye governor enumerated by you.

123 X Q. 67. Now, then, we have in our minds a steam-engine of the pattern shown on the first page of the "Defendants' Exhibit F," which has a cylinder 8 inches in diameter and 9 or 10 inches stroke, capable of developing 30 or 35 horse power, with two pulley fly-wheels on its shaft, said engine being intended to run at 275 revolutions per minute to drive two dynamos, one belted from each wheel, and there is in one of the wheels the governing mechanism of the Buckeye governor, and those wheels are five feet five inches in diameter, with rims one inch thick and six and a half or seven inches wide, and the wheel which contains the governing mechanism is properly constructed to receive said mechanism. Now, let me ask you what mechanical changes would be necessary in the wheel having the governing mechanism therein in order to apply a dash pot in the manner in which it is shown applied in "Defendants' Exhibit A."

A. If a pulley fly-wheel as represented in Exhibit F had been reconverted or recast so as to receive the other portions of the governing mechanism, exclusive of the dash pot, then if the dash-pot arrangement as shown in "Exhibit A" was to be applied it would be necessary to reconvert the fly-wheel pulley for the attachment of this dash pot, so that the combined fly-wheel pulley and dash pot would be produced as a whole in one piece of mechanism.

X Q. 68. You have not answered my question, and I did not refer to the pulley fly-wheel shown in "Exhibit F," but to the one we have in our mind's eye, and I ask you to state what mechanical changes would be required therein to apply the dash pot as shown in "Exhibit A." In your answer you have said it would be

124 necessary to reconvert the fly-wheel pulley, but you did not say what mechanical changes would be made in that reconversion. Now, I will state the question again. We have a fly-wheel pulley five feet five inches in diameter, with a rim one inch thick, six and a half or seven inches wide, properly made to receive the governing mechanism of the Buckeye governor and intended for use on an engine of the pattern shown in "Exhibit F," with a cylinder eight inches in diameter and nine or ten inches stroke, intended to run 275 revolutions. Now, what mechanical changes would be necessary in the construction of that wheel in order to apply to the governing mechanism a dash pot of the same size, form, and construction as the dash pot shown in "Exhibit A" and

applied as it is shown in "Exhibit A?" Now, what changes would you make in the wheel?

A. As I have considered in all your questions, and especially the last one, that in formulating my answer I must have in my mind the cut or elevation of the engine on "Exhibit F" and the blue print marked "Defendants' Exhibit A" in order to give a proper answer—Exhibit——

(Counsel interrupts to explain to the witness: All of the engines shown in "Defendants' Exhibit F," which you are to have in your mind, is general features. I have used the words "an engine of the pattern shown." By that I mean a self-contained center-crank engine with an overhanging cylinder, so far as that cut is concerned. You are to consider no other features, except that the shaft has two fly-pulley wheels on it of the dimensions I have given, and one of those pulley fly-wheels has a Buckeye engine governor in it, and as to "Exhibit A" you were only to consider the form and size
125 of the dash pot and its relative location and manner of attachment.)

A. Continuing my answer after your second interruption, I will say that if we are to consider, as you have stated in the first part of your question, that the governing mechanism of a Buckeye governor is to be placed in a fly-wheel pulley or fly-wheel which shall form a part of the governing mechanism, then we should have to include in that mechanism the disc or casing as shown in Exhibit "A"——

(Counsel interrupting: Nothing of the kind. My question is perfectly plain, and you might answer it if you chose in one line, and I am going to see that you do if I stay here all summer. You are not to consider the disc at all. There is no part of "Exhibit A" that you are to consider except the dash pot and its relative location and manner of attachment, and you can assume that the wheel in "Exhibit A" is not a disc and not a governor case with the rim put on lopsided, but you are to consider that it is a fly-wheel pulley five feet five inches in diameter, with a rim one inch thick and six and one-half or seven inches wide, and constructed to go on the shaft of an engine of nine or ten inch stroke and eight inch diameter of cylinder, and you are to tell me what changes would be necessary in such a wheel having therein the governing mechanism of a Buckeye governor, and when I say governing mechanism I don't mean the governor support or case, but I mean the springs, weight arms, weights, pivots, spring attachments, which are all there, in order to incorporate with that Buckeye mechanism a dash pot just as it is seen in "Exhibit A.")

126 A. That in "Exhibit A" we have, in the first place, illustrated a plan of an arrangement of a dash pot which is wholly unmechanical and——

(Counsel interrupts: That has nothing whatever to do with the answer, whether that dash pot is mechanical or not. What you are

to say is what changes would be necessary in the fly-wheel. We have in our minds to put that dash pot into the governing mechanism, and you know as well as I do that all the change that is required is to drill a hole through one of the arms of the wheel or cast a pin on it so as to form a pivot for the dash pot—only that and nothing more, but you seem determined not to say so. Now, I shall keep interrupting you whenever you start out to talk about anything else. I want a square answer to a square question.)

A. I cannot answer your questions on account of your frequent interruptions, and when you attempt to force me to construct any piece of mechanism in my mind from an unmechanical design and description I must respectfully decline to do so. What you have asked me to do is to throw away the principal parts of a certain mechanism and then hand over to you a complete machine ready to run with these principal parts missing.

X Q. 69. What are the principal parts of the mechanism I have asked you to omit?

A. You have asked me to omit the principal part and only to consider such part as you desired mentioned. You want me to throw away the base for hanging all of our motions. You want me to say that a fly-wheel is not a part of the governing mechanism or a fly-wheel or fly-wheel pulley is a part of the gov-
127 erning mechanism, and I won't admit that, for it is one of the principal parts. Understand, now, that I am within the limits of your question, and the fly-wheel weights, arms, and springs, together with the dash pot, complete this as a unit or whole when considered as a steam-engine governor of the type under consideration and which these letters patent relate to.

X Q. 70. I have asked you to do nothing of the kind. I have asked you to keep in your mind a fly-wheel governor the base or support of which is a pulley fly-wheel five and one-half feet in diameter, with a rim one inch thick and six and a half or seven inches wide and properly proportioned in every respect to do its work, both of supporting the other parts of the governor and serve as a pulley fly-wheel. Now, this is the base or support. The other parts of the governor are formed as in the Buckeye governor, but there is no dash pot in the construction, and I have asked you to say what mechanical changes would be necessary in that pulley fly-wheel in order to incorporate into the governing mechanism a dash pot like the dash pot shown in "Exhibit A," and when incorporated the dash pot is to have the same relative location to the weight arms, springs, and base or fly-wheel that it is shown to have in "Exhibit A." Now, can you tell me that?

A. I will simply say that it is simply impossible to consider a Buckeye governor as a governor unless we have its complete structure, and that it would be a mechanical folly to apply it as such to a fly-wheel or fly-wheel pulley, and that I cannot as an engineer rob the device of any of its principal details and then call it a Buckeye governor, as shown in "Exhibit A."

128 X Q. 71. Please look at "Complainant's Exhibit Buckeye

Engine Catalogue" and look at figure 11 and tell me if there is not a Buckeye engine governor in a fly-wheel shown in that cut and having no other base or support or case than the fly-wheel itself.

A. I hold in my hand "Complainant's Exhibit Buckeye Engine Catalogue," page 15, figure 11, which shows that it has for its governing mechanism a fly-wheel governor, the fly-wheel being a component part of the governor, and that the said governor is not a Buckeye Engine Company's governor, but, as stated before, is a fly-wheel pulley or fly-wheel governor recently adopted by the Buckeye Engine Company and of different construction from the Thompson or real patented Buckeye engine governor, as represented in "Defendants' Exhibit A."

X Q. 72. Looking at the fly-wheel governor shown in this cut, please state what mechanical changes would be necessary in the fly-wheel in order to incorporate into the governing mechanism a dash pot.

A. It would be impossible for me to tell closely the changes necessary to incorporate into the governing mechanism a dash pot without seeing the detailed drawings showing the construction in proportions, such as sizes, distances, etc., but from as close an observation as I can possibly make in examining the cut before me, figure 11, page 15, I am quite sure that it would be necessary to cast a new fly-wheel pulley or fly-wheel in order to incorporate the dash pot as a part of this governing mechanism.

X Q. 73. How would the new wheel which you had cast differ from the one shown in that cut?

A. As I have previously stated, I cannot speak with absolute confidence as to the location of the points of suspension, etc., of
129 the different parts of mechanism, but, to the best of my ability after examining the cut, I consider that it will be absolutely necesary to either cast a lug to one side of the arm or a tie segment, similar to that shown on the cut, which now carries a lever pin or journal and which (I mean the new segment) would have a hub large enough and strong enough with a bearing long enough to carry the trunnion of the dash pot.

X Q. 74. In your opinion as a mechanical engineer would such changes as you have suggested as probably necessary for the incorporation of a dash pot in that fly-wheel governor involve the exercise of invention in view of the construction shown in the Ide patent and the construction shown in "Defendants' Exhibit "A," in each of which the use of a dash pot is shown incorporated, or would such changes be readily suggested to a competent mechanical engineer?

A. If the application and combination was new and useful it would involve the exercise of invention, and if it accomplished the useful results it should be subject to a patent.

X Q. 75. Please look at complainant's patent No. 301,720, at figure 1 of the drawing, and tell me whether or not that figure represents a fly-wheel governor.

A. The figure before me, Fig. 1 of the patent drawing accompany-

ing specifications of A. L. Ide, does show a fly-wheel governor in combination with a dash pot. It is a fly-wheel and governor and dash pot in combination.

X Q. 76. Now, supposing that the dash pot is omitted, then would it be a fly-wheel and governor in combination?

A. If the dash pot was omitted it would be a fly-wheel and governor in combination.

130 X Q. 77. Supposing it to be a fly-wheel and governor in combination, would the fly-wheel have any other or different construction than it has, as shown, when it is a fly-wheel, governor, and dash pot in combination?

A. If the governing mechanism as a whole were laid down or designed according to the drawings of the Ide patent there would be no substantial change necessary as I now notice.

Recess.

X Q. 78. Now, then, supposing Mr. Ide had before him or had constructed and tested a fly-wheel governor the same as is represented in figure 1 of the patent, with the exception of the dash pot, and had found when on his engine that it did not give satisfactory results sought to be determined by the balance forces of the weights and springs when the engine was in motion, and that he ascertained that the difficulty was that there were certain temporarily acting causes of disturbance which changed the position of the eccentric independently of the speed of the wheel, the principal of which disturbing forces he found to be the inertia of the reciprocating parts, including the eccentric and the parts actuated thereby, and the secondary cause to be the gravity of the eccentric, which was unbalanced by a special device for the purpose, and he had then put the dash pot into the combination, would he thereby have made an exercise of the inventive faculty in view of the fact that a dash pot had been used in the Hartford Carpet Company's engine, in the manilla company's engine, on the engine at Dow's store, at Brooklyn, in the manner and for the purposes which have been stated by you in this cross-examination such as would entitle him to

131 broadly claim, as he has in this patent, the combination of the dash pot with relatively movable parts in a fly-wheel governor?

A. I should say that even in view and face of all of the alleged facts enumerated by you in your question that he was entitled to a patent for an invention of a very high order, as he was the first to form and invent the new combination of the fly-wheel, governor, and dash pot combined as a unit, for this combination gives as near absolute perfection and regulation as is possible to obtain, and nearer perfect regulation than any other device heretofore invented, and has been and is of incalculable value in all the electric-lighting systems.

X Q. 79. And you would say this, would you, in view of the fact that the only difference between a fly-wheel governor and a disk or wheel governor which is not a fly-wheel is in the size and weight of the supporting case, and the further fact that the supporting case is

also used as a band wheel and a fly-wheel, in addition to its office as a supporting case?

A. I do not admit that any of your statements or comparisons cover any of my explanations heretofore on this subject, but I positively assert that a governor disk or a governor case or a case supporting any governing mechanism, considered in the light of a case supporting any mechanism, or a band wheel of light rim supporting such mechanism, has any characteristic of a fly-wheel or fly-wheel pulley and will not perform the office in any degree of a fly-wheel or a fly-wheel pulley, and therefore the Ide invention consisted of the combination of the fly-wheel, governor, and dash pot combined as a whole, and is entirely different from the governors on the engines of the Hartford Carpet Company, the Hartford Manilla

132 Company, and Dow's stores (if such governor was placed on Dow's stores' engine and if it was alleged to be like the two before mentioned), and that the said Ide invention has given and does give, to my personal knowledge, entirely different results from those obtained on the engines of the Hartford Carpet Company and the Hartford Manilla Company.

X Q. 80. Was not the object in all cases the same, viz., to secure steady and uniform motion by the incorporation of a dash pot in the governing mechanism?

A. I have previously stated in regard to the Hartford Carpet Company's engines, and, I think, in regard to the Hartford Manilla Company's engine, that the prime object in these two particular cases was to remedy very serious defects in the original design and construction of these engines, in order that suits for damages might be avoided and in order that payment for these engines might be obtained by the builders of the engines, the Buckeye Engine Company of Salem, Ohio.

X Q. 81. Don't you mean to say that the dash pots were applied to those engines to remedy the results of serious defects rather than to say that the dash pots remedied the serious defects of construction?

A. I mean to say that the application of dash pots in the Hartford Carpet Company's engines permitted them to run without wreckage to themselves or the machinery they were driving and accomplished the results sought for to that extent, but they were not perfect in their action, and would not, under any circumstances, perform the offices of a close regulator and would be entirely inadequate for electric-lighting purposes.

X Q. 82. Have you ever seen the Hartford Carpet Company's engines since the dash pots were put on?

133 A. I have.

X Q. 83. Now, is it not a fact that at the Hartford Carpet Company's works two engines set together as a pair, operating together on one shaft, and that the pulley fly-wheel is on that shaft midway between the two engine beds, and that on each side of that fly-wheel there is a Buckeye governor, which are in disks, and that these governors set close up to the hub of the fly-wheel, and that

there are large bolts which pass through both disks and between the spokes of the fly-wheel, which hold the governors firmly in place?

A. The Hartford Carpet Company's engines as rebuilt by the Buckeye Engine Company of Salem have two disk governors on the main shaft on either side of the fly-wheel pulleys, said disk being clamped to the shaft in the usual disk-governor fashion, and the bolts spoken of were simply tie-bolts to prevent the undue springing of the disk plates always present in the disk-plate governor.

(Defendants' counsel now enters objection to the "Complainant's Exhibit Defendants' Dash Pot," for the reason that it is not a facsimile of the dash pots and springs as made by defendant-, and we offer to telegraph to the Ball Engine Company asking that a dash pot and spring be taken from the stock on hand ready for use and sent here by express at once, the same to be substituted for the objectionable; and the counsel, in view of the objection to this exhibit and the statement by complainant's counsel, that Mr. Ide is to be put upon the stand, hereby waives cross-examination of this witness as to matter relating to that exhibit.

134 Complainant's counsel, not admitting that the criticism of defendants' counsel as to "Complainant's Exhibit Defendants' Dash Pot" is correct, but insisting otherwise, nevertheless is perfectly willing that defendants shall produce one of their dash pots of their own manufacture if the same be as represented and if such dash pots shall be recognized and accepted by the complainant, Mr. Ide, who is familiar with the same, and that it is true, as now contemplated by complainant's counsel, that Mr. Ide will as a witness go upon the stand.)

Redirect examination by Mr. OFFIELD:

R. D. Q. 1. Have you any interest, directly or indirectly, in this case and litigation or its results?

A. None whatever.

WILLIAM H. HOFFMAN.

Subscribed and sworn to this 24th day of July, A. D. 1888, before me—

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

Examination of A. L. Ide.

And thereupon complainant's counsel calls as a witness in *its* behalf Mr. ALBERT L. IDE, who, being by me first duly sworn to state the truth, the whole truth, and nothing but the truth, deposes as follows in answer to interrogatories propounded to him by Mr. C. K. OFFIELD:

Q. 1. Please state your name, age, residence, and occupation.

A. Albert L. Ide; 47; Springfield, Ill.; engine-builder.

135 Q. 2. Are you the complainant in this case?

A. I am.

Q. 3. Mr. Ide, will you please go on and state without detailed questioning, somewhat carefully and in an itemized manner, what experience you have had in relation to the organization, construction, and operation of steam-engines or the different parts of the same and which enables you to distinguish and point out the similarities and differences between various steam-engine structures used in the various arts?

A. I began my education and experience as a practical machinist in the year 1859 and served three years as an apprentice in the machine shops of Campbell & Richardson, in Springfield, Illinois. I assisted in the building and erection of steam-engines for saw-mills and grist-mills; all parts of said engines, including the governors, were designed and constructed in our works. I established my present factory, known as the Ide engine works, at Springfield, Illinois, in the year 1870, where I have continued to build steam-engines until the present time. The engines that I assisted in constructing between the years 1859 and 1870, as before stated, were principally for saw-mill purposes, and these engines intended for saw-mills were constructed without governors, a fly-wheel only being used to convert the intermittent power received during each stroke of the piston into a continuous power for driving the saw. The control of speed or governing of these engines was effected by hand, there being a butterfly valve placed in the steam pipe near the throttle valve of the engine, and this butterfly valve was provided with a cross-bar or lever, having a rope connected at each end of this lever and extending near the saw, so the sawyer who was operating the saw could control the
136 speed of the engine through the medium of ropes in connection with the butterfly valve described. As it was not necessary to have a steady or regular motion in sawing logs, the engine governor was entirely dispensed with on engines which we built for that use. On engines designed for milling purposes, for flour mills, etc., where it was desirable to have a reasonably regular power, we constructed and applied a governor known as a fly-ball governor, composed of a small pulley on a horizontal shaft, there being a bevelled pinion on the end of this shaft, which geared into a bevelled pinion on a vertical shaft, said shafts being supported by an upright post or frame. Two round balls or weights were supported or suspended by arms, which were pivoted to the upper yoke, the end of such arms entering the groove of a collar on the upright shaft. On the bottom of this upright shaft and located in the steam pipe leading to the engine was placed a balanced valve, the governing of the speed of these engines being effected through the medium of a belt extending from the main shaft of the engine to the small pulley. The diameter of this small governor pulley was proportioned in size with the shaft so as to give the desired speed at which we required the engine to run. In starting the engine, when it attained this desired speed, the rotation of the governor balls would overcome the attraction of gravitation, causing the balls to rise and depress the vertical stem to which the governor ball was attached, partially closing the valve, thus reducing the supply of steam to

the engine, thus preventing a farther increase in the speed of the engine. When a greater load was applied to these engines, the speed of the engine and governor balls would thereby be reduced, causing the weights to lower, thereby admitting a greater
137 amount of steam to the engine, the effect being to govern or control the engine within a range of speed required for the purposes for which such engines were designed or used. I continued to build this class of engines for a great variety of purposes until the year 1870, at which time I erected works of my own at Springfield, Illinois, and known as the Ide engine works. I continued to build throttling governing engines with the fly-ball type of governors described until about the year 1880 in these works. At about this time my attention was called to the experiments being made by Thomas A. Edison at Menlo park for the perfection and introduction of incandescent electric lights. I went to Menlo park to satisfy myself personally in regard to the probable success and commercial introduction of electric lighting. When I first saw the lights I noticed an unsteadiness and objectionable pulsation and variation of the intensity of the lights, and in a personal interview with Mr. Edison he informed me that this pulsation was occasioned by the unsteadiness of the power derived from the engine. We went in the engine-room and I examined the engine. It was a Corliss engine, built, I think, by George H. Corliss, of Providence, Rhode Island, who had the reputation of building the best and most perfect regulating engine known at that date, and Mr. Edison informed me that he had purchased one of the Corliss engines and had it made especially for his use, because he believed it to be the best engine then made for giving the steady power required for driving electric lights. Each revolution of the engine could be counted by looking at the electric lights, some of which were several hundred feet from the engine in use in lighting the park. Mr. Edison stated that the governing and regulation of this engine was not sat-
138 isfactory, and that a better governing and regulating device for engines would be necessary before he could obtain a steady and satisfactory commercial electric light. This information and investigation turned my mind in the direction of inventing or perfecting an engine suitable for electric-lighting use and one by which the difficulty referred to would be overcome. About one year from this time I purchased and placed in my works a Thompson & Houston ten-light dynamo with ten lamps for furnishing lights in the merchants' stores in Springfield, and this dynamo was driven from the throttle-governed engine which was driving the machinery in my works. These lights were not satisfactory on account of their unsteadiness, and Mr. Thompson, of the Thompson & Houston Electric Light Company, came to Springfield with a view of remedying the defect which caused the unsteadiness of the lights, and he informed me that this unsteadiness was caused by the unsteadiness or irregular speed of the engine which was driving the lights. About one year from this time, or about the spring of 1881, I made up my mind that electric lighting would be a success and

would come into general use for illuminating purposes providing an engine or power could be obtained which could give the steadiness of power necessary to produce a satisfactory commercial light. I went to New York and investigated the different systems of electric lighting then being introduced, and decided to take the Western agency for the Fuller-Wood system of electric lights. I also informed myself in regard to the most suitable engine then being manufactured for the purpose of driving electric lights, being satisfied that the engine I was then building was not suitable for this use; such leading engines then thought
139 most desirable for driving electric lights was the Armington & Sims, then built at Lawrence, Mass., and formerly known as the Lawrence engine, the Porter-Allen engine, built by the Southwark Foundry and Machine Company, at Philadelphia, and the Hampson engine, sold by Edward Hampson, at 34 Cortland street, New York, these engines all being of the type known as high-speed automatic engines. On farther investigation I found the engine called the Hampson was being manufactured by W. B. Payne & Sons, then of Corning, N. Y. I investigated this engine and selected it as being as suitable as any engine then built for this use, and gave Payne & Sons an order for several engines to be used for driving electric lights of the Fuller system, which I was then introducing in the West, having my principal store-room on Washington street, in Chicago. These engines had their governor in a light pulley wheel on the shaft. I sold and placed a number of those engines in store buildings in Chicago for the purpose of driving electric lights of the Fuller and other systems, and they did not prove satisfactory on account of their unsteady motion and irregular speed. On this account and for this reason I then decided to design and construct an automatic engine of superior design and construction if possible, in order to obtain a steady, reliable, and satisfactory power for driving electric lights. I then sold out my electric-lighting business in Chicago and devoted my whole time and attention in designing, constructing, experimenting with, and perfecting a high-speed automatic engine that would fill the requirements for electric-lighting purposes. For this purpose I designed and constructed an engine with the fly-wheel and governor combined; this fly-wheel also was designed to act as a driving
140 wheel or pulley to transmit power, and was of the most perfect design of fly-wheel and governor combined, both as to form and workmanship. After a series of thorough and exhaustive tests and trials I found this governor was not satisfactory and would not give the perfect regulation and steadiness of power and speed required for driving or furnishing perfect and satisfactory electric lights. These being the best engines that could then be obtained, I placed two of them of 80 horse power each in an electric-light station at Springfield, Illinois, run under my own observation. The regulation of these engines did not prove satisfactory, on account of the irregular speeds, causing a variation in the intensity of the lights and causing an unsatisfactory action in the lamps.

I then saw that it would be necessary to provide some means whereby the perfect regulation necessary could be obtained.

Adjourned to Wednesday, July 25, 1888, 2 o'clock p. m.

WEDNESDAY, *July* 25, 1888—2 o'clock p. m.

Parties met pursuant to adjournment.
Present: Same as before.

Resuming my answer—

In the design and construction of this fly-wheel governor I made a wide departure in the form and location of parts from any governor then in use, with a view of overcoming the radical defects known to exist in all other governors, these defects consisting principally in excessive friction on the bearings of the working parts of the governor when the engine was in motion, and this friction was so excessive on high-speed engines as to make it utterly im-
141 possible to adjust the governor so as to obtain a quick and sensitive action under changes of load and at the same time maintain a uniform speed of the engine. After testing my new combination or construction of fly-wheel and governor I found it to be the most perfect governing mechanism which had been produced. It was susceptible of being adjusted in equipoise or in perfect equilibrium of the forces while the engine was in motion. It was sensitive, acting quickly, and responded quickly to a sudden change of load, this result being obtained by locating the weights and springs in direct line so one would pull directly against the other, thus relieving the pivotal bearings from all strain. After perfecting this equilibrious fly-wheel governor I found it impossible to obtain isochronism by its use and that the engines would not run at a regular speed or at a given number of revolutions per minute at all times and under all conditions. It then occurred to me that perfect isochronism could be obtained by a combination of a governor, fly-wheel, and dash pot, the fly-wheel being of sufficient size and solidity to permit the relation and association of these parts in one piece of mechanism to produce this result. I then made the combination of the fly-wheel, governor, and dash pot and it produced the most perfect regulation I had ever known, and its performance exceeded my most sanguine expectations in every respect. With this combination I found it possible and practical to adjust the governors in perfect equilibrium, making it a perfect isochronous governor, which kept the engines under perfect control, causing them to make the same number of revolutions per minute under all changes of load and varying steam pressures without jumping or vibrating when heavy loads were suddenly
142 thrown on and off. On finding this combination produced these excellent and valuable results I believed I had made a great and valuable invention or discovery, especially as applied to the perfection of electric lighting, and determined to apply for a patent therefor, as shown by my patent in suit. Upon further testing this new governor I found it would maintain a perfect isochro-

nous movement of the engine under extreme changes of the load, a result never before accomplished in any kind of engine to my knowledge and belief. I also found by experiment that engines controlled by this new governing mechanism would produce a constant steady power and run the dynamos at a regular speed and produce a perfectly steady incandescent light without any perceptible variation in brilliancy, even when the engine was placed under the most trying conditions, as, for instance, when the engine was running 1,000 lights and 500 of the lights would be switched on and off instantaneously. Under these conditions this new governor would control the engine so perfectly that no fluctuation would be perceptible in the other lamps being driven by the same engine.

Q. 4. To what particular industry was your governing mechanism, as shown by the single claim of your patent, principally intended? And, if you shall state that it was the industry of electric lighting, please go on and state what beneficial result or important advantage was obtained to that system by the governing mechanism of your patent?

A. The invention was made principally to remedy the defects that were apparently proving fatal to the industry and commercial success of electric lighting. Before my invention and its introduction the electric-light companies experienced great difficulty
143 in obtaining a sufficiently steady power to produce a steady and reliable electric light, the unsteady motion of the engines causing the arc lamps to work irregular and produce a flickering light, and sometimes this unsteady motion would cause their extinction and temporary suspension of the lights. I have known many electric-light systems utterly failing to give satisfaction or satisfactory results on account of the irregular speed of the engine. I can recall several instances where electric-lighting installments have proved unsatisfactory and were rejected and removed from the buildings on account of the unsteadiness and irregular running of the engines, and in some instances, where lights were defective for this reason, my engines have been placed for driving the same lights containing the invention of my patent with perfectly satisfactory results. The necessity for steady power is of still greater importance in the application of incandescent electric lighting, as a very slight variation in speed of the engine will produce a very objectionable flickering or variation in the lamps, besides greatly reducing their service or durability, and, as the renewal of exhausted incandescent lamps is one of the largest items of expense in commercial electric lighting, it is of the greatest importance that a steady light should be obtained. The incandescent electric lamps which are in general use, sixteen-candle-power size (consisting of a carbon filament forming the light loop and enclosed in a hermetically sealed glass bulb from which the air is exhausted), *which* costs from seventy-five cents to one dollar each. Each lamp usually is guaranteed by the manufacturer to give a service of six hundred hours with steady power. It is the experience of electricians and others that where a steady power is furnished the
144 durability of these lamps will average from six hundred to

one thousand hours, and where an unsteady power is used for driving these lamps their average service will be from three hundred to five hundred hours. I know of a number of electric-light stations where the dynamos and lamps — driven by my engines containing my invention where the incandescent electric lamps are standing a service of over a thousand hours average, and many of these lamps are giving a service of over two thousand hours. I know of no such results being accomplished by the use of other engines.

Q. 5. Please state what effect the introduction and incorporation of the claimed governor mechanism of your patent into your engine structure had upon your business of the manufacture and sale of such engines, particularly for electric-lighting purposes.

A. It had a very immediate and marked effect, its value being recognized at once for electric-lighting purposes. My business has increased to a wonderful extent, more than doubling the number of engines sold since the invention, and, finding it impossible to supply the increasing demand for these engines at my factory, at Springfield, I entered into contract relations with the Harrisburg Car Manufacturing Company, at Harrisburg, Pennsylvania, to build my engines containing my invention, the invention being practically the basis of the contract (that company being one of the largest manufacturers in the country, working one thousand to one thousand five hundred men). They have to this date built and sold several hundred of my engines, and have placed them in some of the largest and most important electric-light stations of this country, among which I recall the Edison station, at Harrisburg, Pennsylvania (five engines, running five thousand commercial
145 electric lights.) The Excelsior electric-light station at Harrisburg, Penn., using seven engines, running several hundred arc lights, which are lighting the streets of Harrisburg; the electric plant lighting Washington, D. C., and many others in the principal Eastern cities and States. The Union iron works of San Francisco also desired to build my engine after investigation, and I made contracts with them giving them the sole right for the Pacific coast, and they are now building my engines extensively and placing them in the immense Government vessels and war ships now being built by them for the Government and for shipping to foreign countries. The Union iron works have the largest and most complete works in the United States. My business has increased since the introduction of this invention into my engines to such an extent that I have been unable to build enough engines to supply the pressing demands. I am now building a large addition to my works which will increase my manufacturing capacity one hundred per cent., and I now have about one hundred men employed as against 25 employed before this invention. I have agencies established for the sale of my engines in Chicago, St. Paul, Kansas City, St. Louis, and Denver, Col., Chicago being my principal agency and distributing point. I have sold several hundred engines with this invention, every one of which has given entire satisfaction for the results mentioned. All of these engines contain my invention, as since its adoption I build no others.

Q. 6. Can any electric-lighting engine be run commercially without a fly-wheel or fly-wheel pulley?

A. It cannot.

Q. 7. What peculiar characteristic has a fly-wheel which at once identifies or distinguishes it from any other weight attachment put on an engine shaft?

146 A. A fly-wheel must have a diameter from three and one-half to five times as great as the length of stroke of the engine, and a heavy rim containing sufficient metal to convert the intermittent power into a steady and continuous motion. It can readily be distinguished by the diameter, width, and thickness of rim and size and strength of hub and spokes in proportion to the size of the engine, the spokes necessarily being heavy and located in the middle of the rim. Any ordinary mechanic can at once recognize a fly-wheel from any other attachment or weight on the shaft. Nearly all fly-wheels made at the present day are provided with wide rims for the transmission of power by the use of a belt.

Q. 8. When did Mr. Ball, one of the defendants, first see an engine containing your invention?

A. In the month of September or October, 1884. At the time he saw this engine it was driving Edison incandescent lights for lighting the Exposition building and Music Hall in St. Louis, Mo., and this engine had a tachometer attached, which indicated the number of revolutions at which the engine was running at all times.

Q. 9. What kind of governing mechanism up to that date had the defendants used in their engines?

A. They had used a shaft governor in a small light pulley, the same as appears in "Exhibit F;" on cuts, figure 1, page 40, page 11, figure 3, and in detail on page 4, figure 1, and on the back of the exhibit.

Q. 10. Prior to 1884 did the defendants have any dash pot in connection with their governor and small light-weight pulley?

A. No; not to my knowledge.

Q. 11. Was the small light pulley carrying the governor
147 in the Ball engine prior to 1884 in any sense of purpose or use a fly-wheel?

A. It was not or never so claimed and considered.

Q. 12. After the year 1884 what changes did these defendants make of construction in the governing mechanism of their engine?

A. They discarded their light pulley containing the governor and substituted therefor a fly-wheel pulley with governor and dash pot combined, substantially the same as shown in my invention, as to mechanism, purpose, object, and result.

Q. 13. Can the term or definition "fly-wheel governor" mean or distinguish any other structure than a governor located in the fly-wheel itself?

A. It cannot.

Q. 14. In the Ball or defendants' engines prior to 1884 was there a fly-wheel upon the shaft with this fly-wheel pulley?

A. There was a fly-wheel pulley on the end of the shaft opposite

from the governor pulley, and it was absolutely necessary to have this fly-wheel pulley to permit the running of the engine.

Q. 15. Mr. Ide, have you personally examined and familiarized yourself with the construction, operation, and application of the old disk governors with after-applied dash pots now in use on the Hartford and Manilla Companies engines and testified to by several of the defendants' witnesses and by Mr. Hoffman in this case?

A. I have.

Q. 16. How recently?

A. Within the last six months.

148 Q. 17. Did you see these engines containing those governing disks both at rest and in motion?

A. I did.

Q. 18. Are you familiar with the Buckeye governor engines as manufactured by that company from the beginning; and, if so, please examine "Defendants' Exhibit B" and state whether such exhibit represents any Buckeye-engine governor ever manufactured by that company to your knowledge or any of the governors on the Hartford and Manilla Companies' engines testified to, and give your reasons fully for your opinions or statements of facts.

Recess.

A. I am familiar with the Buckeye-engine governors as manufactured by the Buckeye Engine Company of Salem, Ohio, and as also manufactured by the Hartford and Manilla Company, and the model "Exhibit B" does not correctly represent any Buckeye-engine governor that I have ever seen, and to my positive knowledge does not correctly represent the Buckeye governors on the Hartford Carpet Company or the Hartford Manilla Company or any cut in any Buckeye-engine catalogue that I have ever seen. My reasons are as follows: First, it does not correctly represent the proportions of any governor that I have ever seen that was built by the Buckeye Company or the Hartford Engineering Company, because the diameter of the pulley portion of the governor, as represented by the model, is twelve times the diameter of the shaft on which the governor is placed, which is more than twice as large as was ever used. To correctly represent a Buckeye governor on a shaft of the present model, the containing

149 disk or pulley should not exceed five inches in diameter instead of twelve, and every other part of the governor is distorted with respect to the shaft. The model also differs from every Buckeye engine that I have ever seen, on account of being mounted in a pulley wheel, such as is ordinarily used for transmitting power instead of their ordinary containing disk with offset rim. The flange or rim of the pulley on this model extends equally on both sides of the spokes, and the hub on the sides of the pulley extends out a considerable distance beyond the rim, while in the Buckeye governors, as formerly manufactured, the flange or casing to protect the parts of the governor projected only on one side and the hub portion of this disk projected only a short distance beyond the end of the disk. In their governors of more recent construction

they have cored holes through the disk for giving free access to the other parts of the governor, still retaining the offset construction of the rim. I have been familiar with the Buckeye-engine governor for several years, having first seen their engine running in the Centennial exposition in 1876, since which time I have seen a large number of their engines applied to various uses and have been called upon to repair and adjust Buckeye-engine governors and have made new parts of the governors of both the Salem and Hartford Engine Company's engines in my works.

Q. 19. Would or did the governor containing disks of the Buckeye Engine Company, testified to by the defendants' witnesses as having applied to them dash pots in the Hartford Carpet Company and the Manilla Company's engines, contain, indicate, point out, or suggest in any manner the inventions, combinations, and devices set forth in your patent and covered by the single claim thereof, and if not, why not?

150 A. It did not contain my invention and certainly did not suggest it to the Buckeye Engine Company nor anybody else, because they never adopted it or never even constructed an engine containing my invention. Furthermore, in my opinion, it never could or would suggest my invention to anybody. In the first place, it is impossible to apply my invention to a disk or shaft governor, as contained on those engines, for the reason, first, that owing to the manner in which these governors were constructed it would be a mechanical impossibility to obtain equilibrity of the weights and springs, and this was impossible because the containing disk was too small to locate weights in their proper position so as to attach springs which would directly oppose the centrifugal force of the weights without transmitting their power through the pivots and bearings of the levers, and on account of the disk being of small diameter extremely heavy weights were required, these weights on the Hartford Carpet Company's engine weighing several hundred pounds. This immense weight in itself would prevent the prompt and quick action necessary to produce an equilibrious and isochronous governor on account of the action of gravity affecting the steady action of the governor at each revolution. Another reason why it is a mechanical impossibility to make an isochronous and equilibrious governor as constructed on the Hartford Engine Company, and which, therefore, does not suggest my invention, is because it is a mechanical impossibility to construct a spring that will vary in strength in the exact proportion as the resistance varies while the eccentric is being revolved on the shaft. In this Buckeye disk governor the application of centrifugal force to revolve the cut-off eccentric is peculiar, the connecting links being so at-

151 tached to the lugs of the eccentric that a relatively great force is required to revolve the eccentric when the weights are nearest the shafts. After the weights have moved out about half their distance their leverage on the eccentric is largely increased, enabling them to move the eccentric with less centrifugal force, and when the weights are moved still further out the lugs are revolved to such position as to require an increase of centrifugal force. Therefore, in

order to balance the weights in equipoise and produce an equilibrious governor, it would be necessary to use a spring that would give its greatest resistance when partially extended, or one which is a mechanical impossibility. Another difficulty in the way why said Buckeye governor did not suggest my invention and could not contain it is because equilibrity, equilibrium, and isochronism cannot be obtained on account of the excessive friction that was always present in those governors and was occasioned by their heavy weights springing the light supporting disk, thus straining the joints and bearings out of line and causing increased internal friction. Owing to these defects, it would have been impracticable and dangerous to have attempted to run a governor of that description at the high speed necessary to furnish a steady power, such as is required for driving electric lights. Another reason why these Buckeye disk governors could not suggest and did not contain my invention is because, owing to the small diameter of the disk, it was impossible to locate a dash pot of proper design so as to produce the results obtained in my invention or in such a manner as to ensure the successful operation of an equilibrious governor. This is because
the dash pot must be placed with the chamber radially with
152 the shaft, so that the piston will travel in the lines of centrifugal force, thus preventing friction or binding of the parts. A dash pot located as shown by "Defendants' Model of Buckeye Engine Governor" would utterly defeat the objects of my invention, and especially if so applied to a high-speed engine, as the centrifugal force when the engine is running would act on the dash pot and its piston rod and spring them out of line and cause them to bind and prevent the prompt and sensitive action of an equilibrious governor, and thus wholly defeat the object of my invention. As seen by "Defendants' Model of the Buckeye Engine Governor," the dash pot is supported pivotally at one end, the piston rod being supported pivotally at the opposite end. When the engine is running and governor in operation the piston rod is extended, making a long distance between the points of support. The centrifugal force, acting sideways on the dash pot, will cause the parts to bind and the stuffing box to leak, and thus defeat the successful and sensitive action necessary to my engine, and that is contained in my fly-wheel governor. Another reason why this Buckeye engine disk governor with dash pot did not and could not contain my invention is because the weights were necessari*a*l*l*y confined to a range of movement near the shaft, which not only necessitates great weight of the balls but also occasions wide difference of centrifugal force upon the balls at their outer and inner extreme positions. In my fly-wheel-governor mechanism all of these defects are eliminated and overcome, as, for example, the fly-wheel forms a rigid and yielding base on which to support the structure and working parts of the governor. The large diameter of this wheel permits the use of longer levers, which are fulcrumed on pivots at a greater distance from
the shaft and further from their ends, thereby allowing the use
153 of longer connecting rods, which will move in nearly direct lines or straight lines, both moving in the same direction

(instead of pulling in opposite directions, as shown in the model of Buckeye-engine governor), thus avoiding acute angles and consequent friction and unequal transmission of the forces or power of the weights and springs in the rotating or shifting movements of the eccentric. By locating the levers a greater distance from the shaft I avoid friction and overcome one of the inherent and radical defects, which is in all governors with weights located near the shaft. Another advantage gained by the combination of the fly-wheel, governor, and dash pot is permitting the weights to be located at a greater distance from the shaft, which causes them to travel at a high rate of speed, producing greater power and effect, thereby permitting the use of very much smaller and lighter weights, thereby overcoming to a great extent the evil effects of gravitation and inertia, and reducing the friction of the pivotal bearings to the minimum. The light weights and reduced friction permits the quick and sensitive action absolutely necessary to obtain an equilibrious and isochronous governor like that shown and described by my patent. Another advantage obtained by my combination of the fly-wheel, governor, and dash pot is that it affords ample room to permit the use of springs of sufficient length and size and permits their proper location in the fly-wheel, governor, and dash pot, so their resistance when being extended will increase in the same relative proportions as the forces of the weights increase in their outer movement, thus permitting the adjustment of the springs at their full theoretical initial tension, which condition is necessary to maintain equilibrium of the forces of the weights and springs in
154 all positions of the weights in their outer and inner movements without causing any perceptible variation or change in the speed of the engine, thus making a truly equilibrious governor. Another advantage gained by the combination of the fly-wheel, governor, and dash pot is it permits the best location of the dash pot of the best proportions to be attached at or near the free end of one or both of the levers, where the travel is the greatest and where the dash pot has the greatest effect, and for this reason may be made of smaller diameter and be placed lengthwise in a direct radial line from the shaft or parallel with the spokes of the wheel, so the piston will travel in the direct line of centrifugal force, in which position it will be free to move without friction of parts, and when in this position the glycerine or oil is by centrifugal force kept in the dash pot and not thrown from the stuffing box. Under these conditions the dash pot will give the steady and controlling effect which is absolutely necessary to insure the practical and successful operation of an equilibrious governor. Therefore by the combination of the fly-wheel, governor, and dash pot, as described by the specifications, drawings, and claims of my patented fly-wheel governor and by the proper construction, location, and arrangement of the parts, as described and shown, by such a combination of a fly-wheel, governor, and dash pot combined in one piece of mechanism which act together in harmony as a unit and produce and accomplish new and valuable results which never were and never could be accomplished by any device or combination before in use.

Q. 20. From your knowledge of the Buckeye engines what
155 defects existed which at all times tended to render them dangerous or destructive to the engine- themselves?

A. The inherent defects in all Buckeye-engine governors was locating excessively heavy weights near the shaft and connecting the weight levers to the eccentric in such a manner that it required a much greater force to start the eccentric in its rotary motion around the shaft than would be required to rotate the eccentric when in its intermediate or natural working condition. For this reason it was necessary to adjust the springs at a tension very much below their full theoretical initial tension, in order that their resistance would not prevent the weights from leaving their initial position until the engine had attained a speed considerably beyond the normal speed at which it was designed to run. On account of this apparently necessary slack adjustment of the springs in their initial position in starting the engine before it had attained its normal speed the action of gravity on the heavy weights and the resistance of the unbalanced engine-valve and friction of the stuffing box, all of which had a tendency to alternately force the weights back and forth from their initial position, thus causing the weights to vibrate and pound against the eccentric to such an extent that there was danger of breaking of the parts. This vibrating and pounding action of the weights would also frequently be set up when a sudden change of load occurred on the engine. This pounding action also occurred in shutting the engines down. This vibrating or pounding of the weights was always liable to occur, and it was a well-recognized defect in the construction of the Buckeye engines and was liable to occur at any time under a sudden change of load or if the lubrication of the valve ceased and the friction became
156 excessive on either valve or stuffing box or both. These defects were not so apparent in some engines as in others, but in my opinion were greatly aggravated and more troublesome in the engines of the Hartford Carpet Company and Hartford Manilla Company on account of the low rate of speed at which these engines were run, and in my opinion the dash pots were put on those engines for the sole purpose of preventing the slamming and pounding action of the weights due to these inherent defects named and was not put on for the purpose of improving the regulation of the engines.

Q. 21. Please state what there is in your patent in suit which makes it unqualifiedly certain that the wheel portion of your governor is a fly-wheel or fly-wheel pulley.

A. The relative size and proportions of the wheel and shaft. The drawings represent the wheel as being eleven times the diameter of the shaft. The drawings also represent the rim of the wheel as being one-half the thickness of the diameter of the shaft and two times the diameter of the shaft in width. Besides, the spokes represented are shown to be as wide as the diameter of the shaft and their thickness half the diameter of the shaft; therefore being four times stronger than would be required or is ever used in a pulley for the transmission of power only. Any mechanic would recognize it as a

fly-wheel from the drawings alone in view of these proportions. The specifications and claim also designated it in positive terms as a fly-wheel. The terms governor and pulley wheel used in the specifications simply imply that the construction of wheel shown could be used for the purpose of a pulley or driving-wheel.

Q. 22. You have frequently used in your deposition hereto-
157 fore the terms equilibrity, equilibrious, governor, isochronous, isochronous governor, and isochronism as inherent in or resulting from the combined mechanism covered by the claim of your patent in suit. Please define the scope and meaning and intention with which you have used these terms in relation to your invention.

A. Equilibrity is a balanced condition of the centrifugal force of the weight and centripetal force of the springs. Equilibrium means that the weights and springs are in this balanced condition, and an equilibrious governor is one in which, when running, these forces remain balanced while the weights are in all positions from their initial or innermost position to their ultimate or extreme outer position.

An isochronous governor is one which will cause the engine to make the same number of revolutions per minute, regardless of the change of load or work which may be thrown on or off the engine. It will also count the same or make the same number of revolutions per minute with the weights in any position in their range of movement. Isochronism is the result of equilibrity in a governor when the equilibrity is made possible. By my invention I have, for the first time in the history of this art, made equilibrity of the governor practical and isochronism or isochronous action possible and certain.

Q. 23. Whereabouts in your patent in suit are these qualities and characteristics of your invention pointed out and defined?

A. My entire patent from beginning to end proceeds on that idea. The following clauses specifically refer to and identify this fact—the following words: "Means for holding the eccentric steadily in its proper poised position in opposition to the tendency of
158 certain extraneous forces which are calculated to disturb the movements of the valve, as sought to be determined by the balanced forces of the weights and springs when the engine is in motion." Here the words "balanced forces of weights and springs" directly refers to the equilibrity that I have mentioned; also the following clause, page 1, line 67: "A dash pot constructed and attached to the apparatus in such manner as to prevent sudden movements of the weight lever or eccentric is found in practice to wholly overcome the defects indicated and to give a desirable steadiness and regularity to the movements of the movable parts of the governor, as well as accuracy and reliability to the cut-off action of the valve."

The sudden movements of the weight levers referred to are the natural movements which are peculiar to a sensitive or equilibrious governor.

This equilibrity of the governor and the consequent isochronous action thereof when the dash pot is applied is again set forth on

page 2, line 41, viz: "By means of the dash pot applied to the relatively movable and stationary parts or to the unequally moving parts, as described, wide and sudden radial movements of the weights E are prevented, and, as a consequence, the governors will have a steady and efficient action at all speeds of the pulley and wheel to which said governor is applied." The wide and sudden movements of the weights E clearly refer to the action of an equilibrious governor when not restrained or controlled by the dash pot; and the meaning of the words "and, as a consequence, the governor will have a steady and efficient action at all speeds of the pulley or wheel to which said governor is applied" is that an isochronous action of the governor would be produced.

159 Q. 24. Did those Hartford Carpet and Manilla Companies' engines have in any sense the movements and action identified by these quotations from your patent?

A. They did not and could not, because they were not susceptible of an equilibrious adjustment. The objectionable movement which they necessarily had was and must have been the jumping and pounding of the heavy weights they employed, instead of the wide and sudden movements referred to in my patent.

Cross-examination by J. K. HALLOCK, Esq.:

X Q. 1. Mr. Ide, I hold here in my hand a bound volume containing copies of a number of patents issued to you, all of which in some manner relate to the construction of steam-engines. Will you please take this book and state to me which of the inventions herein shown and patented are embodied in the construction of your superior steam-engines referred to in your answer?

(Objected to as incompetent, indefinite, and not cross-examination.)

A. All of the patents are embodied in the construction of my steam-engine.

(Defendants' counsel asks that these copies of patents be put in evidence as exhibits.)

(Complainant's counsel declines to dump into the case a lot of patents not in the slightest degree material to any issue here involved, and so declines simply on account of the incompetency, irrelevancy, and immateriality of such a proceeding, particularly a request made on cross-examination.)

(Defendants' counsel says that the position of the case now
160 is this: A *prima facie* case was made out, which *prima facie* case was squarely met by the defendants on an issue strictly of prior use, we having shown the use of steam-engine governors of the same type as complainant's, wherein a dash pot was combined with relatively movable parts, and now, in rebuttal, the complainant, by himself as a witness, attempts to show the superiority of his engine, and we find that in the construction of his engine he uses a large number of inventions which, it is true, are not involved

in this issue or would not be if the complainant's rebutting evidence was confined to the limits of the issue, but in view of ungermain testimony it may become a question for the court to say whether the superiority of the Ide engine is attributable solely to the invention described and claimed in letters patent 301,720 or not; therefore these copies of patents may be properly introduced into the record, and we therefore offer in evidence as an exhibit the bound volume referred to in the preceding question and mark the same "Defendants' Exhibit Bound Volume of Complainant's Patents.")

(Complainant's counsel, not desiring to reply to the argument of defendants' counsel at this time, objects to this exhibit as incompetent, irrelevant and immaterial, and not proper cross-examination.)

X Q. 2. Please look at the second patent in this volume and state whether that patent, No. 308,498, is not named in the bill of complaint in this case and the infringement thereof charged therein.

A. Yes; it is.

X Q. 3. It has been decided, has it not, on your part that
161 the defendants did not infringe on that patent, and notice of such decision was given by your attorneys to defendants at the time you made out your *prima facie* case?

A. I think so.

X Q. 4. Please look now at the model of your governor, which is marked "Complainant's Exhibit Complainant's Governor," and state whether that is an exact model of the governors you use on your alleged superior engines for electric-lighting purposes.

A. It is the exact model used on all the engines, there being a few engines in use which were manufactured before the sliding block to which the end of the spring is attached was adopted. In all other respects it is the same as used in all of my engines since the date of my patent in suit.

X Q. 5. There are in use, then, I understand, a few engines which were made before you got up the invention of the sliding block, which invention, I understand, is the one described and claimed in letters patent 308,498 in the book exhibit?

A. Yes, sir.

X Q. 6. Are there any engines of yours in use? I mean the high-speed automatic engines which were made before you got up the invention described and claimed in letters patent 301,720, which is the patent in suit, properly speaking. By this I mean are there any engines in use of that kind with a fly-wheel governor thereon having no dash pot?

A. There are not.

X Q. 7. Before you got up the dash-pot combination had
162 you made any governors having weights, weight arms, and springs similar to those shown in your two patents, 301,720 and 308,498?

A. The governors I built before making the dash-pot combination

were not precisely of the same construction as the model or shown in the patent.

X Q. 8. Was there any material variation?

A. There was.

X Q. 9. What was it?

A. But one lever and weight was used, and a flat, el-iptical spring was placed in the rim on the opposite side of the wheel from the weight to oppose and resist the centrifugal action of the weight.

X Q. 10. That was an experimental governor, I suppose, was it not?

A. It was designed as an experiment, but several engines were built and put in use, but after making this new invention I believe they were all changed or new governors placed on the engines.

X Q. 11. Mr. Harris Tabor, a witness for the defendant, in answer to Q. 13 of his disposition, on page 16 of Defendant's Record, answers as follows: "In 1879 and for a few years following B. W. Payne & Sons, Corning, N. Y., now of Elmira, manufactured and put on the market substantially the same device. The only difference I can recall now is the attachment of the spring to the weight arms. In this case the weight is between the pivot of the arm and the attachment of the spring to the weight arms. In the case of Payne & Sons' governor the spring was attached to the weight arm at some point between the weight and the pivot." Is that statement true?

A. It is not true.

X Q. 12. Please point out wherein it is not true.

163 A. Between the years 1879 and 1883 I visited the works of Payne & Sons, of Corning, N. Y., and purchased several of their engines. I was informed then they were building engine-governors under Tabor's patent, said patent consisting of a pendulum or swinging eccentric, with a connecting rod attached to one side of the eccentric, said rod being attached to a lever near the fulcrumed end and a weight attached to the end of the lever, this weight being opposed by a spring attached to the opposite side of the eccentric and the rim of the governor wheel or pulley. The combination and patent consisted of a weight and spring on each side of the eccentric acting in opposite directions. I understand that Payne & Sons built a few engines with this governor and they proved so unsatisfactory that its further use was abandoned. They then constructed their governors with the pendulum eccentric, but used two connecting rods and two levers, and two weights resisted by two opposing springs, but this construction was entirely different in design, proportion, and location of the parts from the construction of my governor, the differences being as follows: the weight levers E with their weights E′ were located very much nearer the shaft. The connecting rods G were very much shorter and connected very close to the pivoted points of the levers. The springs were very much heavier than those used in my governors and were made of square steel bars, similar to that used in car springs. These rigid springs were attached to the lever at points very close to the fulcrum *e* and were placed under a tension of over five hun-

dred pounds on each spring. The weight levers E were excessively heavy in order to overcome the great resistance of the springs.

X Q. 13. This Payne governor which you have just con-
164 trasted with your own governor parts, exclusive of the dash pot, was used in combination with a pulley fly-wheel, was it not?

A. I think not.

X Q. 14. Were none of the engines which you bought of Payne & Sons constructed with pulley fly-wheel with governors therein?

A. I think the majority of them had the governor in a light pulley of comparatively small diameter and a large and heavy driving pulley on the opposite end of the shaft similar to the cut on the outside of the catalogue of the Ball Engine Company, marked "Defendants' Exhibit E," as those engines which I purchased were all small engines, and in no case was more than one dynamo driven from one engine, the larger pulley being used to drive the dynamo. I am not sure.

X Q. 15. You do not claim, do you, to be the first to put the governing mechanism of a steam-engine in a pulley fly-wheel?

A. I do not.

X Q. 16. Referring again to your model "Complainant's Exhibit Complainant's Governor," supposing the rim of the wheel there shown had the same amount of metal that it has in it now, but the rim in place of being wide and flat was round in cross-section, would that not be a fly-wheel?

A. It would.

X Q. 17. Supposing, again, that the rim was the same shape it is now, but was thin and did not have the amount of metal that it now has, would that not be a belt pulley?

A. It could be used as a belt pulley.

X Q. 18. Supposing, again, that the pulley, instead of being
165 in the form that it is now, had a thin rim of the same width or greater width, which projected wholly to one side of the wheel, that side being the side on which the governing parts are located, would that not be a governor case?

A. It might properly be used for casing the governor.

X Q. 19. Supposing, again, that that wheel had the same metal in it that it has now, but was so cast that the spaces between the spokes were filled and the rim was wholly on one side and that side was the same side as the governing parts were located on, would that not be a disk?

A. Yes; of course it would.

X Q. 20. If it had a governor located in it, might not that governor be called a disk governor?

A. Yes.

X Q. 21. And if it had a governor located in it precisely like your governor, with the exception of the dash pot, would it then be a disk governor?

A. Yes; but nobody ever saw a disk governor of that kind or proportion.

X Q. 22. Never mind about that, whether anybody ever saw one

or not. If there was one, is it not a fact that it would not contain the element named in the claim of your patent number 301,720?

A. If it was a fly-wheel and had a dash pot it would.

X Q. 23. I want an answer to my question.

A. If it had no dash pot, of course it would not be my combination.

X Q. 24. Would it if it had a dash pot?

A. That would depend upon whether it was a fly-wheel and had the equilibrity and isochronism of my invention.

166 X Q. 25. My question contemplates an exact duplicate of your governor in all particulars, including the dash pot, but excluding the fly-wheel, and in place of the fly-wheel there is to be a disk which had the same amount of metal in it that there is in the fly-wheel, and I ask whether such a device would contain the elements named in the claim of your patent number 301,720. The disk is to be the same diameter as the fly-wheel.

A. It would be impossible to get my governor in such a disk, because you have excluded the fly-wheel portion of the governor in your question; besides the other portions of my governor, if properly proportioned, could not be placed in the sized disk you have named.

X Q. 26. Have not you at any time or any of your licensees—for example, the people at Harrisburg, Penn.—constructed an engine having your governor located in the wheel which was neither used as a fly-wheel nor as a belt wheel, but was used solely as a governor case or support?

A. Yes; two such engines have been constructed by the Harrisburg Car Manufacturing Company, and the reason this special construction was adopted on those engines is owing to the peculiar location in which those engines were to be placed, there not being room for the fly-wheels or driving wheels to be located in the position on the shaft where it is necessary to place the governor, but as these engines were not intended for electric-lighting purposes—one for grinding cement and one for running grindstones and other machinery of that class, where a steady power and close regulation was not necessary or of much importance or expected—the Harrisburg Company deviated from their regular practice in those two special cases to meet the demands of the special location, and in these governors no effort was made to obtain equilibrity,

167 isochronism, or close regulation, and I don't consider them as containing my invention.

X Q. 27. You took your royalty all the same, didn't you?

A. I received no royalty on those two engines.

X Q. 28. Have you not at some time declared that the subject-matter claimed in letters patent No. 301,720 related solely to the dash pot and not to the other parts shown and described?

A. I have no recollection of ever having so claimed.

X Q. 29. Haven't you any recollection of ever having made this declaration in substance under oath?

A. I have not.

X Q. 30. I will now quote to you from your patent No. 308,498

as follows: "The several parts of the governor hereinbefore described are constructed and operate substantially in the manner set forth in the application for letters patent of the United States before referred to as made by me on the 11th day of July, 1883, and now pending. Such parts do not, however, with the exception of the dash pot hereinbefore referred to, form the subject-matter of claims in said application, the parts of the governor considered to be new being claimed herein," as appears on page 2, beginning with line 17, and I ask is not that a declaration that the parts of the governor described in letters patent 301,720 do not, with the exception of the dash pot, form the subject-matter of the claim in said patent 301,720, said patent having been applied for on July 11, 1883.

A. The patent in suit shows for itself what I claim and invented, and I never intended anything else and don't understand anything else about it.

X Q. 31. You say you did not receive any royalty for those engines. Do you never expect to?

168 A. I never expect to receive royalty on one of them, but I hope to receive the royalty on the other, for the reason that it contains the inventions of several other patents on which the manufacturers are paying me a royalty.

X Q. 32. Your licensees pay you a royalty on other patents besides 301,720, do they?

A. They do.

X Q. 33. Why do they do that? Do they find it necessary to use those other inventions in order to make your alleged superior engine?

A. It is not necessary to obtain perfect regulation, but desirable to make a better engine in other respects, in my opinion.

X Q. 34. Is not the invention shown and claimed in your patent No. 308,498 essential to perfect regulation?

A. It is not essential, but a convenient method for readily adjusting the springs to their full theoretic initial tension in producing perfect equilibrity.

X Q. 35. Do you not say in this patent, 308,498, that "it is impossible by the use of the adjusting devices described (which were the devices shown in your patent 301,720 and in other fly-wheel governors) only to so adjust the springs and weights that the resistance of the springs will vary exactly in proportion to the centrifugal force of the weights at all points in the movement of the latter," and, beginning on line 59 of page 2, "in order to obtain a sensitive action and accurate regulation with the class of governors described the weights and springs must be so adjusted that a slight variation in the speed of the wheel will cause an extreme movement of the weights, and in order to produce this sensitive action the weights must be

169 relatively so adjusted that the resistance of the springs will increase just in proportion as the centrifugal force of the weights increases in their outward movement"? What do these declarations mean if they do not mean that the invention shown and described in this patent 308,498 is not essential to the perfect regulation of your governor?

A. It says: "It is impossible by the use of adjusting devices described only to so adjust the springs," etc. Now, there are other means of adjusting springs besides those described. I do not see or find any other adjusting devices described in my other patent and referred to in this patent.

Adjourned to Saturday, July 28, 1888, 10 o'clock a. m.

SATURDAY, *July* 28, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.

Present: Same as before.

Cross-examination resumed:

X Q. 36. Please look at the drawings of your patent 301,720 and tell me if the governing mechanism therein shown is capable of being adjusted so as to give isochronism or so as to make the governor equilibrious under all variations of the weights to produce variations of speed. I mean initial speed or intended speed of the engine, and by the variation of the weights I mean the adjustment of the same at different points on the weight arms, by which the normal or intended speed can be regulated.

A. As shown by the drawings, the governor can be constructed so as to make it equilibrious and isochronous and produce all the desirable results claimed in the patent.

X Q. 37. How can it be so adjusted?

A. By the selection and use of springs of the proper length and proportions.

X Q. 38. There are no means shown in that drawing, are there, by which the tension of the springs can be regulated?

170 A. There is not.

X Q. 39. And in order to make the governor isochronous and equilibrious it is necessary to select springs of proper length and proportions, you have said, and you would also say and tension, or, more properly speaking, perhaps, I had better use the words initial resistance?

A. The proper tension or initial resistance or full theoretic initial tension of the springs could be obtained by the adjustment of the lug which holds the end of the spring on the fly-wheel pulley hub, the lugs shown in the patent being provided with a longitudinal slot, where the set-screw passes through which secures it to the hub.

X Q. 40. Will you please point to that feature in this drawing?

A. In figure 2 the slot is shown and in figure 3 in section shows the lug in dotted lines with three holes, but in practice the metal was cut out between the holes, leaving a slot. In practice there was also another provision made, not shown in the drawing, whereby the tension of the springs might be adjusted. This consisted of a threaded eyebolt, which passed through the end of the lug, with a nut on each side, and the end of the spring was hooked into the eyebolt, but this eyebolt is not shown on the drawing. The drawing shows the end of the spring hooked through the lug, which is not a

mechanical way of attaching it and it was never attached in that way.

X Q. 41. I have not asked you to state how it was constructed in practice or how it might be done. The question is, as the construction is shown in the drawing, is it not a fact that there are no means shown whereby the springs can be adjusted so as to get per-
171 fect equilibrium at any of the various adjustments of the weights upon the weight arms?

A. It is not a fact. There are means shown on the drawing whereby such equilibrity may be accomplished if the proper size and properly proportioned springs are used.

X Q. 42. Is it not a fact that springs of equal size and proportion on account of differences in temper and other causes are not always of the same strength and also act with different degrees of force when stretched to the same extent, and that therefore in order to get perfect adjustment, so as to get perfect equilibrium, it is necessary to have some means provided for stretching the springs so as to get them exactly alike in tension, as stated in your patent No. 308,498, in substance and effect? I refer you to the clause beginning on page 2, line 59, and ending with line 74.

A. As I understand, this is a compound question, and to answer it intelligibly I shall have to answer one part of the question "yes" and the other part "no." Can you not present the question or each part of it in a more simple form so I can answer it direct?

X Q. 43. To which part do you answer "yes"?

A. In your question you say, "Is it not a fact that springs of equal size and proportion on account of differences in temperature and other causes are not always of the same strength and also act with different degrees of force when stretched to the same extent?" I will answer this part of the question yes. In answer to the remaining part of the question I will state that by selecting and testing different springs we found it possible to obtain springs that could be adjusted with the appliances shown on the patent,
172 so as to make an equilibrious adjustment of the governor, so as to produce an isochronous governor, but the selection of such springs required great care and experiments by placing and testing different springs in the governor until a spring of the proper resistance could be obtained.

X Q. 44. As you have said in answer to cross-question 41 that you never made an engine with the springs attached without the use of screw-threaded eyebolt, which is not shown in the drawing, do you not wish your last answer to be understood as referring to a device having such screw-threaded eyebolt?

A. I do not.

X Q. 45. Then what do you mean by saying, in answer to X Q. 41, "The drawing shows the end of the spring hooked through the lug, which is not a mechanical way of attaching it and it never was attached in that way"? Now, how was it attached when you used these selected springs which you have referred to in your answer to X Q. 43?

A. If I had answered my last question more fully or had ex-

plained it I think you would not have asked me this last question. If you will permit me I will explain my answer to your previous question.

X Q. 46. You have said that the drawing shown in the invention of patent 301,720 is not a mechanical way of doing the thing; that, in fact, the springs were never connected in your governor in the way they are shown in the drawing, but that a screw-threaded eye-bolt was used. Do you now wish to contradict that?

A. I do not. In my answer referred to I also stated that the drawings do show a slot in the lug, by which means the ten-
173 sion of the springs can be adjusted. My reference to the eye-bolt was merely incidental, and I did not claim that it was used for the adjustment of the spring, but only used as a proper mechanical construction, and I can now answer your previous question by saying by means of the slot shown in the lug it was possible if necessary to adjust those special springs which had been selected after testing to their full theoretic tension and produce all of the desired effects named in my patent.

X Q. 47. Yet you admit that you never have done so, do you not—in other words, you admit, do you not, that you have never made a governor with the springs attached as shown in your patent 301,720, depending wholly on the sliding lug as a means for adjusting the springs? Now, there is no "might have been" about this question. It is what you actually have done that is inquired of.

A. I do not admit that I have never made a governor according to these drawings, as you state, but have made a number of them exactly as shown by the drawings.

X Q. 48. Where are any of these governors now to be found?

A. One is now in use in the works of the Springfield Shoddy mill, at Springfield, Illinois, and one at the Hot Springs Electric Light Company, Hot Springs, Arkansas, and I believe two more at the electric-light station at Belleville, Illinois, and possibly others.

X Q. 49. Please look at the specifications of your patent 301,720 and point out any descriptive matter therein which describes the manner of attachment and the manner of adjustment of the springs so as to get an equilibrious governor.

174 A. Beginning on line 17, page 2, "and the opposite ends of said springs are attached to suitable points on the pulley," and the drawings also show a provision for adjusting the springs, and the whole specifications of the patent indicate that such an adjustment is contemplated.

X Q. 50. And the specification of your other patent, 308,498, says, does it not, "The several parts of the governor hereinbefore described are constructed and operated substantially in the manner set forth in the application for letters patent of the United States before referred to as made by me on the 11th day of July, 1883, and now pending. Such parts do not, however, with the exception of the dash pot hereinbefore referred to, form the subject-matter of claims in said application, the parts of the governor con-

sidered to be new being claimed herein"? I quote from page 2, line 17.

A. That is the way I read it.

X Q. 51. Please look at the drawing of patent 301,720 and tell me how far the slotted lug, as shown, can be moved.

A. It could be moved a distance of over half the diameter of the shaft.

X Q. 52. Does the equilibrity which you refer to mean the same rate of speed under different loads?

A. I have defined the meaning of equilibrity in my direct examination.

X Q. 53. I want you to answer my question.

A. That might depend upon the language used in connection with the word. If you will refer to the exact place where I used it I will answer whether it did or not in that connection.

X Q. 54. What was the definition you gave of equilibrity?

175 A. It is a balanced condition of the centrifugal force of the weights and centripetal force of the springs.

X Q. 55. Is there anything in the specification of your patent which would teach a person how to balance the centrifugal and centripetal forces of the governor by a proper adjustment of the weights and springs so as to get equilibrity? I mean your patent No. 301,720.

A. There are no printed directions, but the drawings show how it can be accomplished.

X Q. 56. That was a matter of common knowledge, was it not, at the time you got up your invention?

A. It was not.

X Q. 57. Then you do not agree with your patent solicitor and expert, Mr. Dayton, who said in his cross-examination when on the stand at the time of taking your *prima facie* testimony, in answer to X Q. 22, which reads as follows: "Now, please point out in the specification whatever language there is which would teach a person how to balance the centrifugal and centripetal forces of the governor by the proper adjustment of the weights and springs," to which he answered as follows: "A. There is nothing in the patent which attempts to give this information, all that being a matter of common knowledge in the art."

A. If Mr. Dayton meant that equilibrity was a common knowledge in the art, I then agree with him. If he meant the adjustment of an equilibrious governor was a common knowledge in the art, I do not agree with him.

X Q. 58. Do you agree with Mr. Dayton when he says, as he did in your *prima facie* case in answer to X Q. 23, "The adjustment of

176 weights and springs or means for such adjustment is no part of the invention, either primary or secondary, but the object of the invention is to obtain several effects in an adjusted governor, and the means by which these effects are obtained is with the dash pot"?

A. I do agree with Mr. Dayton in stating that means for adjusting the springs are not claimed in this patent No. 301,720.

X Q. 59. And you agree also, I suppose, *that* the statement in your patent No. 308,498, where it refers to the application for said patent No. 301,720 and the several governing parts shown therein, except the dash pot, which says, "Such parts do not, however, with the exception of the dash pot herein referred to, form the subject-matter of the claims in said application"? I begin to quote on line 23, page 2, of patent 308,498.

A. I do not claim any parts of the governor separate, but claim the combination of the parts in a unit as a complete governor, for the purposes and accomplishments as stated in the patent.

X Q. 60. Then is it not true that the objects of the invention described and claimed in patent 301,720 is to obtain several effects in an adjusted governor, and the means by which these effects are obtained is the dash pot, as stated by Mr. Dayton in his answer to cross-question 23?

A. The dash pot is one of the means by which these effects are obtained. I do not understand that Mr. Dayton has stated that the effects are obtained only through the use of the dash pot.

X Q. 61. Mr. Dayton, in answer to X Q. 21 of his deposition in the *prima facie* case, said, "Something else is, of course, required. In fact, the dash pot has nothing to do with balancing the gov-
177 ernor. The balancing of the governor is accomplished by the proper selection and adjustment of the opposing weights and springs. The dash pot makes practicable a governor which is adjusted to a balanced condition or to substantial equilibrium," and in answer to cross-question 24, which reads as follows: "Do you wish to be understood as changing your previous answer, namely, the answer to X Q. 21, in which you say the dash pot has nothing to do with the balancing of the governor, but that it is effected by a proper adjustment of the weights and springs?" to which he answered, "I do not." Now, what other construction could the defendants in this case have put upon the language of Mr. Dayton as I have quoted it from time to time in the past few questions than that your invention as claimed in your patent 301,720 consisted of the incorporation of a dash pot in a governor for the purposes named in said patent?

A. You can put the same construction on Dayton's several answers that I do, that the invention consists of the incorporation or combination of a fly-wheel governor and dash pot, because in answer to cross-question 21, in which you ask him if the balancing of the centrifugal and centripetal forces are effected by the use of the dash pot, he replies, "Something else, of course, is required," and this "something else" means the combination of the fly-wheel, governor, and dash pot, as I understand it.

X Q. 62. You are a little off, I think, and need a dash pot to give your memory a steady motion, for Mr. Dayton, in answer to X Q. 24, which I have just quoted above, distinctly says "that the dash pot has nothing to do with the balancing of the governor, but that it is effected by a proper adjustment of the weights and
178 springs," and there is not a single word about a fly-wheel in any of Mr. Dayton's answers which I have quoted. Now, hadn't you better amend your answer?

A. I think not, because I consider Mr. Dayton's deposition as a whole.

X Q. 63. Will you point out in Mr. Dayton's deposition any place where he lays any stress whatever or attaches any meaning whatever to the words in a "fly-wheel governor," as used in your claim, or in any way intimates that the incorporation of your mechanism for governor, together with the dash pot, in any other form of wheel which is not a fly-wheel would not come within the scope of your invention? I will give you until Monday morning to answer that question, this being Saturday adjournment.

Adjourned to Monday, July 30, 1888, 10 o'clock a. m.

Monday, July 30, 1888, adjourned to Tuesday, July 31, 1888, 10 o'clock a. m.

TUESDAY, *July* 31, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.

Present: Same as before.

Cross-examination of Mr. IDE resumed:

A. To me the entire deposition means nothing else and the fly-wheel is mentioned in many parts of his deposition; for instance, in answer to question 4, direct examination, he says: "The invention consists for any or all the purposes which it is adapted to accomplish in the combination stated in the claim already quoted." Now, this refers to the fly-wheel because it is one of the parts of the combination named in the claim. Also in the first part of the answer he says: "In the fly-wheel governor, the combination with
179 relatively movable parts of a dash pot, substantially as described. The drawings and descriptions of the patent set forth the fly-wheel of a steam-engine provided with levers E, pivoted to the arms A of the fly-wheel and carrying weights *e* at a distance from the pivotal points. These weights in the rotation of the fly-wheel have a tendency to move outward under the action of centrifugal force; such centrifugal force is opposed by springs F attached at their outer ends respectively to the weight levers E and to the fly-wheel." I do not find any questions about any other kind of wheel considered in his cross-examination. As Mr. Dayton is going on the stand again you can ask him.

X Q. 64. Then it is a fact, is it not, that there is nothing in Mr. Dayton's deposition *prima facie* which can be construed as a declaration of the limitation of your invention or of the claim of the patent to the use of a dash pot in a governor in a fly-wheel in contradistinction to the use of a dash pot in a governor in a wheel not a fly-wheel?

A. It does not speak of a dash pot in any other connection except as in a fly-wheel designated in the claim of the patent.

X Q. 65. And there is no intimation in that deposition, is there, that the substitution of any other wheel for the fly-wheel would produce a different combination which would effect other and different results?

A. There is nothing said about any other combination, no questions having been asked about the substitution of any other wheel for the fly-wheel.

X Q. 66. At the time that deposition was taken you had seen the affidavits filed by the defendants in the Springfield case, which are reprinted in this little book which I hand you, had you not, and you had also before the date of that deposition personally
180 inspected the engine at the Hartford Carpet Company's works and the manilla company's works, had you not?

A. Yes; I had.

(Defendants' counsel offers the pamphlet in evidence, and the same is marked "Defendants' Exhibit Defendants' Pamphlet." Objected to as wholly and totally incompetent, irrelevant, and immaterial.)

X Q. 67. And you had seen a copy of this pamphlet, had you not, before that deposition was taken?

(Last objection repeated.)

A. Yes, sir.

X Q. 68. Have you ever in any of your catalogues laid any stress on the fact that the incorporation of the levers, springs, and dash pot in a fly-wheel was of any particular advantage over their incorporation in any other form of wheel, and have you not always in your catalogue spoken of your governor as being attached to or supported by the fly-wheel or the band wheel? In some instances you say band wheel and in some you say fly-wheel, do you not?

A. All of the cuts of my engine or fly-wheel governors in any catalogue I have ever issued show the combination of fly-wheel governor and dash pot, and the language of the description in these catalogues referring to the cuts clearly describes the construction of the governor combined with the fly-wheel and dash pot. The reason it is referred to in some places as a band wheel is because it is provided with a wide face to take a belt. The descriptive matter in the catalogue is this: "The automatic safety governor is shown in position in the fly-wheel." On another page in the same catalogue under the heading of perfect regulation it reads: "The
181 automatic cut-off governor is simple in construction and perfect in its operation. All its parts are in sight and are readily accessible for cleaning. It is secured to the side of the band wheel and connects through eccentric or main shaft direct to rock-shaft without the use of gearing, pulleys, shafts, or belts." Now, the words "band wheel" used in this case means the fly-wheel, because it refers to the same cut, but in this case was called band wheel because the rim was wide enough to drive a belt. In a catalogue of more recent date, under the heading of more perfect regulation, the two names or terms are both applied to the wheel in the same connection as follows: "The automatic cut-off governor, simple in construction and perfect in operation, is shown in position in fly-wheel. All parts are in sight and are readily accessible for cleaning. It is secured to the side of the band wheel and

connects through eccentric in main shaft," etc. Now, in this place the two names are applied to the wheel in the same connecting lines, showing that the term "band wheel" may be properly applied to a fly-wheel that has a wide rim.

X Q. 69. Will you please point out in any of your catalogues or advertisements or in the specifications of your patents where you have ever referred to the fly-wheel as performing any of the functions of the government or regulation other than that of a support for or the place of attachment of the automatic cut-off governor mechanism or have described or named any new result or effect or advantage obtained by reason of the attachment of your governor to the fly-wheel in contradistinction to its attachment or support in any other wheel?

A. My catalogues do not show any other wheel and I never built my governors with any other wheel and my patent did not
182 contemplate building them in any other wheel except the fly-wheel, so there was no contradistinction or discussion about it and none was necessary.

X Q. 70. That does not answer my question. I want you to either find the matter inquired of and point it out or tell me it isn't there. Will you do so?

A. My patent clearly shows, both by the drawings and specifications, that the fly-wheel portion of the governor does perform a very important function in the construction and operation of the governor, as it is one of the essential parts, and it would not be a governor without it.

X Q. 71. In your catalogue you say, "The automatic safety governor is shown in position of the fly-wheel," and in another place it says, speaking of the automatic cut-off governor, "It is secured to the side of the band wheel." This language clearly refers to the fly-wheel or band wheel as a support for the governor. Now, what I have asked you to do is to point out where in any of your catalogues or the descriptive matters of your patents you refer to the fly-wheel as anything else other than a support or where you describe any other function performed by the fly wheel than of a support for the governor. Now, if you can find such language quote it, and if you can't admit the fact like an honest man.

A. The fly-wheel or band wheel does perform other and very important functions in the governing and controlling of the engine besides acting as a support for the levers of the governor. It equalizes the motion and speed of the engine and furnishes a means for transmitting the power of the engine to the work to be performed, besides giving a desirable steadiness and regularity to the action of other parts of the governor and the cut-off motion of the valve, and by its combination enables the governor to accomplish
183 all advantages claimed in the patent and as set forth in my catalogues.

X Q. 72. You are still dodging. Point out the language I have asked for if it is to be found.

A. In my drawings, claims, and specifications the fly-wheel is a

part of the governor, and it performs its portion of the government duty as much as any other portion of the governor.

X Q. 73. Point out to me any language in your catalogues or patents assigning any other function or office to the fly-wheel than that of a fly-wheel and belt pulley combined and a support for the automatic governor, and let your attorney assist you, if you desire.

(Complainant's counsel suggests that at the proper time he will assist the court in locating the invention of this patent if necessary and pointing out defendants' infringement thereof.

Defendants' counsel, seeing the witness consuming so much time, thought he would suggest that the counsel might assist the witness to make the answer, as he had done in many previous instances without criticism by me.)

A. I cannot see that the patent shows any other special function which the fly-wheel performs as a part of the governor except those I have named.

X Q. 74. I again ask for an answer to that question. If the language is there you can point it out, and if it is not I want you to say so.

A. I will point out the principal language. On page 1, beginning at line 11, the patent says: "This invention relates to that class of steam-engine governors known as fly-wheel governors or
184 those which comprise a laterally movable eccentric upon the crank of the engine, the centrifugally acting weights operating in connection with centripetally acting springs to vary the position of said eccentric, so as to regulate the movement of the valve and thereby produce a uniform speed of the engine." Now, the fly-wheel is named as one of the parts of the invention, and the drawings and specifications of the patent clearly show that the fly-wheel part of the governor performs its functions in the operation of the governor and the governing of the engine as well as any other parts of the governor, and this fact is clearly shown, although I cannot find any words that express it in exact terms in which you have put it. The exact language you have used not being in the patent, I cannot point it out.

X Q. 75. You have here a bound volume of various catalogues issued by you and your licensees at Harrisburg, have you not?

A. I have.

X Q. 76. Are you willing to allow me to put that bound volume in evidence as an exhibit?

A. It is the only volume I have got and the books are out of print and cannot be replaced without great expense, and for this reason I prefer not to part with it.

X Q. 77. Will you have this book present in court at the time of the argument of this case, so I can refer to it if I desire?

A. Yes; I will.

X Q. 78. I hold in my hand here one of your cataloguges from which you have made quotations, called "Catalogue B, July, 1885." Do you identify this as one of your catalogues?

A. I do.

185 (Counsel for defendants offers in evidence as an exhibit the catalogue just referred to, and the same is marked "Defendants' Exhibit Complainant's Catalogue B, July, 1885.")

Objected to as incompetent, irrelevant, and immaterial.

X Q. 79. Please look at "Complainant's Exhibit Complainant's Model" and tell me how you adjust that governor and when you make the adjustment—that is to say, whether you make the adjustment before or after the parts are assembled.

A. I make the adjustment after the parts are assembled by turning the screw which slides the block that holds the end of the spring, thus moving it nearer to or farther from the hub of the pulley, the effect of which will be to cause the spring to stretch more when it is nearest the hub or less when it is farthest from the hub during the outer movement of the weights. There is also a nut on the threaded eyebolt, by which means the tension of the springs may be increased or diminished, and by the combination of the two screws the proper adjustment of the spring is conveniently and readily obtained. The method of adjustment is fully described in my patent for this device.

X Q. 80. Is this adjustment made after the engine is completed and while on the testing block?

A. It is.

X Q. 81. Supposing, after the engine was tested and the governor adjusted to your satisfaction, you were to turn down the rim of the wheel so that it was only an inch thick, would that necessitate any change in the adjustment of the governor?

A. It would not necessitate any change in the adjustment,
186 but would probably spoil the successful operation of the governor.

X Q. 82. Why?

A. Because the fly-wheel would then be too light to give a steady motion to the governor and engine.

X Q. 83. But suppose that the engine on which it was used had two wheels, one on each end of the shaft, as is common in self-contained engines, and the metal taken off of this wheel was added to the other wheel, then what?

A. I never tried the experiment and don't know of any one else ever trying such an experiment.

Recess.

X Q. 84. In the governor of which we are just inquiring what other or different function, if any, would the dash pot perform before the rim of the wheel is turned down to an inch in thickness that it will not perform after the rim is turned down?

A. After the rim is turned down the whole operation and performance of the governor would be different, and the governor then would probably not be an isochronous governor, because the reduced weight of the wheel would cause the wheel to vary in speed during each revolution of the engine, thus causing an intermittent pressure to act on the dash pot at each revolution, and it would not produce

the effect nor control the governor as it would with a fly-wheel of the proper weight.

X Q. 85. But the engine I am inquiring of is to have enough metal in the other wheel to give the proper weight in the balance wheel. What I want to get at is this—would the dash pot perform any other or different functions when in a governor which is
187 in a fly-wheel than it does when it is in a governor which is in the band wheel, the engine being provided at some other point on the shaft with the proper amount of balance wheel? You are to understand that the band wheel and the fly-wheel have the same diameter. You are to further understand that the weights and springs and eccentric, means of adjusting the springs, and the manner of adjusting the springs are all to be the same as are shown in your model.

A. In answer to the first part of the question I will say if the engine had enough weight in the other wheel to control the engine properly after the governor wheel was turned down it would have too great a weight of metal to enable the governor to act quickly and properly before the governor wheel was turned down. In answer to the latter part of your question, I never saw one of those governors constructed in that kind of a wheel, and don't know what its operation would be and could not tell unless I saw the construction. It certainly would be an unnecessary expense and labor to make both wheels when it could all be constructed in one fly-wheel, as shown in my invention.

X Q. 86. Well, then, I understand that you are not prepared to swear that the dash pot would perform any other or different office in one case than that which it performs in the other case. Is that right?

A. That would depend upon the kind of wheel it was in. I certainly am prepared to swear that it would perform an entirely different duty if in a fly-wheel, as shown in my patent, than it would perform if placed in any pulley or wheel that I have ever seen in use with the governor.

X Q. 87. Your patent says, in speaking of the office of the
188 dash pot—that is to say, the result of its use—beginning on line 41, page 2, "By means of the dash pot applied to the relatively movable parts and stationary parts or the unequally moving parts as described wide and sudden radial movements of the weights E' are prevented." Would not the dash pot when thus applied in one of your governors which was fixed to a band wheel prevent wide and sudden radial movement of the weights?

A. You have proposed an impossibility. I can only answer your question by saying it would be impossible to attach one of my governors to a band wheel unless that band wheel was also a fly-wheel. It would then contain my invention.

X Q. 88. Now, it is time that this nonsensical way of answering questions be stopped. You know it is not impossible to put your governor in a band wheel that is not a fly-wheel, for you have said that that very thing was done in the two large Harrisburg engines. You know that if the wheel shown in your model here—if the rim

was turned down thinner would be a band wheel and would contain your governor. I know what you are trying to get at. You are trying to avoid my question and make a false answer to it, because you think that a fly-wheel is part of the combination of your patent, but you say in your own catalogue when you speak of your automatic cut-off governor that it is attached to the side of a band wheel. Now, when I use the term automatic governor or governor I use it in precisely the same sense that you use it in your catalogue—that is to say, that the weights and the springs and the dash pot are the governor. Now, with that understanding I want you to answer the previous question.

189 (Complainant's counsel objects to the personality of this question and the unwarranted imputation contained therein, and calls attention to the fact that the answers of this witness are all that could be expected from the complex, ingenious, and compound character of the questions asked, which seem to have for their object the confusion of the witness instead of the ascertainment of facts.

Defendants' counsel states that there is nothing whatever compound about the 87th cross-question. It was a simple, direct question, and I ask to have it read again to the witness.)

A. I never said that. I know it is impossible to put my governor in a wheel that is not a fly-wheel, and I have never said or intended to say that the Harrisburg Company put it in a band wheel. You asked me if the Harrisburg Company had not constructed two engines with the governors placed in a containing disk separate from the fly-wheel and I told you they had, but that such governors did not contain the elements of my invention and were not intended or expected to give perfect regulation. Your questions are mixed in with argument and compound questions so I cannot tell whether I have answered all parts of them or not.

X Q. 89. Well, then, I will see if I cannot state a question that you can understand. Now, supposing we had a wheel on an engine that was exactly the same size as your fly-wheel, except that it had a thinner rim, so that it was a band wheel and not a fly-wheel, and the engine was provided with another wheel sufficiently large and heavy to perform the functions of the fly-wheel, and in the band wheel was an automatic cut-off governor, with the same weights, same weight arms, the same springs, the same manner of

190 adjusting the springs, and the same dash pot, arranged the same, all of these parts in every respect like those in your model, then, I ask, would not the dash pot in such a construction prevent wide and sudden radial movements of the weights?

A. Undoubtedly it would have a tendency in that direction.

X Q. 90. We have used the terms in this examination "initial tension" and "full theoretical initial tension" and "less than full theoretical initial tension." Now, will you please define these terms in order as you understand them?

A. Initial tension means beginning tension, the first tension, the tension at which the springs are permanently fixed when the

weights are in their initial position or in their innermost position, where they remain when the engine is not in motion. Full theoretical initial tension is accomplished when the fixed or initial tension of the spring is sufficient to stretch the spring to such an extent that it will just balance the force of their weights at a given speed of the engine at all points in their movement from their innermost or initial position to their outermost or extreme position. Springs of proper proportions are susceptible of this adjustment and, when so adjusted, are said to be adjusted to their full theoretic initial tension.

Less than full theoretical initial tension means that the initial tension of the spring is less than that required to produce a full theoretic tension, and when springs are so adjusted under a given speed of the engine the weights will start from their innermost position, but the resistance of the springs will increase faster than the centrifugal force of the weights in their outer movement
191 and the weights will be poised and brought to a state of rest. Then a still higher speed of engine will be required to again overcome the resistance of the springs and allow the balls to move still farther from the shaft, thus requiring an increased speed of the engine in order to carry the balls to their outermost or extreme position.

The object in adjusting springs to their full theoretic initial tension is for the purpose of causing the weights to move from their innermost or initial position to their extreme or outermost position without requiring an appreciable or perceptible change in the speed of the engine, thus causing the valve to travel from its shortest to its longest range and enabling the engine to develope from its least to its greatest power without an appreciable or perceptible change of speed. The object in adjusting springs at less than full theoretic initial tension is for the purpose of giving stability in the action of the governor.

X Q. 91. You have spoken in your direct examination of the great increase of your business. That change took place, did it not, when you adopted the manufacture of first-class high-speed automatic engines?

A. Yes; containing the fly-wheel, governor, and dash pot.

X Q. 92. Can you attribute your success in business any more to the dash pot than to any or all the other improvements which you have patented and which go to make up the general excellency of your engines?

A. Yes; I attribute the success and reputation of my engines principally to that invention, it being the first or fundamental patent on which I established the reputation of my engine. Of course it required an engine of good construction and principle in other parts.

192 X Q. 93. You could not have increased your business to anything like its present proportion if you had used your fly-wheel dash-pot governor on one of your old throttling engines, could you?

A. I could not have used it on one of my old throttling engines,

because they were slide-valve engines, and my new combination governor, fly-wheel, and dash pot would not operate on that kind of an engine.

X Q. 94. The Ball engine is a slide-valve engine, is it not?

A. I do not so understand it. I believe Mr. Ball claims the valve is balanced or partly balanced. I believe he uses a patented valve of his own invention and entirely different in construction, principle, and operation from those in use on my old engines.

X Q. 95. You never made but a very few engines but what had on them a governor exactly as represented in your model, did you?

A. I don't remember exactly how many; don't know what you mean by the term "very few."

X Q. 96. How much did your trade increase before you adopted the device for delicately adjusting the springs which is shown in your patent 308,498?

A. It more than doubled what my trade was previous to the adoption of my new governor.

X Q. 97. How much did your trade increase after you adopted the invention shown in 308,498 over what it was between the time you quit making the old slide-valve engine and the time you adopted that device?

A. My trade kept increasing all the time. I couldn't tell exactly how much. Our books would show.

193 X Q. 98. How many other establishments are there in the United States that make a specialty of making first-class high-speed automatic engines, which are used for operating electric-light plants?

A. Four or five only, that I know of.

X Q. 99. Please name them.

A. The Ball Engine Company, Armington & Sims, the Straight Line Engine Company, New York Safety Steam Power Company, some parties at Chambersburg, Pennsylvania, whose names I do not recollect; Buckeye Engine Company, who sell a few.

X Q. 100. Are there not a good many Corliss engines used for electric-lighting purposes, particularly where the plant is very large—I mean engines of the Corliss type, regardless of the manufacturers?

A. I should say there are not many used, and I can refer you to large electric-light stations where Corliss engines were first put in and have since been taken out and replaced by high-speed engines.

X Q. 101. Could your governor be used to handle a Buckeye valve?

A. I don't know. I never tried it.

X Q. 102. Didn't you tell me the other day that it could not?

A. I don't remember of any such conversation, because I never tried it and wouldn't know without trying it. I remember of conversation with you some time in which I said that my engine governor would not be adapted to run a Buckeye engine, because their engine has two valves, one of which is very large and heavy, requiring a great deal of force to move it. Their engine also requires two eccentrics, which makes it so complicated. I told you I

194 did not consider it adapted for electric lighting, and do not consider it a first-class electric-lighting machine.

X Q. 103. In the Buckeye engine one of the two eccentrics you named is fixed to the shaft, is it not, and is not moved by the governor, while the other is a shifting eccentric which is handled by the governor, and which operates the cut-off valve?

A. In reply to the first part of your question, yes. One of the Buckeye eccentrics is fixed to the eccentric and moves the main valve. I do not call the other eccentric a shifting eccentric, but think it may be more properly called a rotary eccentric, because it revolves on the shaft and is not shifted or carried across the shaft, as is the case in the eccentric of my governor and the Ball Engine Company's governor. This conversation and explanation applies only to the old-style Buckeye engines with two valves. The Buckeye Engine Company, as shown by their catalogue, have recently brought out a new engine with single valve, which I believe they claim to be a balanced valve, and in this engine they have abandoned their former disk governor and have placed in it a fly-wheel governor. They call this their high-speed electric-lighting engine, and it is represented on page 15 of Buckeye Engine Catalogue, figure 11, and under the cuts is printed "Front view of high-speed automatic, style C, with subbase and single valve."

X Q. 104. You have in this deposition often used the word "isochronous." Will you please define your meaning of the word when used to describe the movements of a steam-engine?

195 A. Isochronous or isochronism is regularity or uniformity of motion under variable conditions. It is the effect or result obtained by the perfect arranging proportions balancing and adjusting the weights and springs in the balance wheels in steam-engines or watches. The term is more generally understood as applied to watches. Watches so adjusted are said and advertised to be adjusted to isochronism because they will run at a regular uniform rate of speed, making the same number of beats or revolutions of the balance wheel each minute in every hour and each hour in every day regardless of their position or time of winding. Such are isochronous watches, and will at all times accurately indicate the correct time. The term isochronism when applied to governors and engines means the same effect that is produced in isochronous adjusted watches—that is, a regular and constant movement under all conditions which the engine is intended to run. An isochronous governor is one in which the construction and adjustment of the parts are brought to such a state of perfection that the governor will perfectly control the engine, causing it to make the same number of strokes or revolutions per minute and per hour at all times under varying loads and varying steam pressures. Such engines may properly be called isochronous engines, and if provided with gearing, dial, and hands would make correct time-keepers.

X Q. 105. What is meant when you say that an engine will run within one per cent.?

A. It means a variation from true isochronism of one revolution in a hundred.

X Q. 106. Are there not a number of manufacturers of engines for electric-lighting purposes who claim to be able to so adjust their governors as to get within one per cent. of true isochronism?

196 A. I never have known of any manufacturer of engines making such claims except myself and the Ball Engine Company, and the Ball Engine Company did not accomplish or claim such regulation before they adopted my invention.

X Q. 107. I refer you to the Buckeye Engine Catalogue which you put in evidence, page 36, under the head of "good regulation," where it says: "If the machinery driven contains in itself considerable momentum to assist that of the fly-wheel and is not subject to sudden and extreme changes of resistance, the conditions are favorable to close regulation, and in such cases the variation of speed can, if desirable, be confined within one per cent. or less." Is not that such a claim as I inquired of in my previous question?

A. It is not such a claim. You have stopped in the middle of a paragraph, the rest of it reading as follows: "But when the load is destitute of momentum or *vis viva* and is subject to great and sudden changes it may be necessary to adjust for a greater variation, according to the nature of the load; but in any case much closer regulation can be had than is possible with the ordinary or pendulum governor and as close as the conditions would permit with any system of regulation. The percentage of variation is adjustable at will by varying the amount of initial tension given to the governor spring, the more initial tension the closer the regulation within the limits beyond which the necessary stability of equilibrium would be lost." Now, this whole description of their governor and its action substantiates and proves conclusively that any statement in regard to their governor is correct. The concluding words of the paragraph I have

197 just quoted, "the more initial tension the closer the regulation within the limits beyond which the necessary stability of equilibrium would be lost." The paragraph only claims that under the most favorable conditions a variation of speed if desired can be confined within one per cent. or less, but when the load is destitute of momentum and is subject to great and sudden changes it may be necessary to adjust for a greater variation (meaning a greater variation in speed according to the nature of the load). Then it goes on and says, "But in any case much closer regulation can be had than is possible with the ordinary pendulum governor." Now, every one familiar with the art knows that the pendulum governor does not even approach close regulation, the variation with its use being from 10 to 20 per cent.

X Q. 108. Do not the manufacturers of the Armington & Sims and the Straight Line engine also claim to get regulation within one per cent.?

A. I do not know or understand that they make any such claims.

(Counsel for defendants now closes the cross-examination and enters objection to direct questions 2, 3, 4, 5, and 21 and to matter in answer 19 as containing matter which should have been presented

in the *prima facia* case and because said matter is not in rebuttal of any of the defendants' proofs.)

Adjourned to Wednesday, Aug. 1, 1888, 10 o'clock a. m.

WEDNESDAY, *Aug.* 1, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.
Present: Same as before.

Redirect examination by C. K. OFFIELD, Esq.:

R. D. Q. 1. I now desire to call your attention particularly
198 and in detail to the several patents after the patent in suit appearing in "Defendants' Exhibit Bound Volume of Complainant's Patents" for the purpose of ascertaining whether or not such patents affect in any substantial degree the utility and value of your engine or governor. The first as to patent 308,498, of Nov. 24, 1884, for an improvement in steam-engine governors. What added value did this patent give to the governor structure, and did your engine have any additional market value by reason of such invention?

A. It was a detailed matter of convenience for our own use and the user of the engine to enable the springs to be more readily and quickly adjusted. It did not increase the market value of our engine or cheapen its manufacture and was in nowise designed or intended to improve the regulation of the governor.

R. D. Q. 2. The second patent in this Defendants' Exhibit Bound Volume Complainant's Patents is dated March 24, 1885, No. 314,381, for an improvement in steam-engine frames. State what added value or effect this patent had to your engine structure.

A. This was an engine frame that I had designed and used from the first introduction of my automatic engines. As it proved to be a good rigid design, I concluded to patent it and continued its use, but it had nothing to do with the regulation of the engine or the action of the governor, and I do not attribute the success of my engine to the special design of the frame.

R. D. Q. 3. I call your attention to the third patent in the Bound Volume Exhibit, No. 319,261, dated June 2, 1885, for an improvement in steam-engine valves, and ask you to state what added value this patent gave to your engine structure.

199 A. This improvement had directly nothing to do with the regulation or government of the engine. It was a detail in the construction of the valve and steam chest and involved no additional price on the sale of the engine.

R. D. Q. 4. The fourth patent in this Bound Volume Exhibit is No. 319,819, dated June 9, 1885, for an improvement in valve gear for steam-engines. State what added value the device of this patent gave to your engine, if any.

A. This device was for equalizing and perfecting the valve motion, but after using a short time was found to be of no special value, and as it considerably increased the cost in the construction of the engines I abandoned its adoption and use.

R. D. Q. 5. I call your attention now to the fifth patent in "Defendants' Bound Volume Patent Exhibit," No. 321,726, dated July 7, 1885, for an improvement in steam-engine cross-head lubricators, and ask you what added value this patent gave to your engine mechanism.

A. This patent had nothing to do with the governing or running of the engine, but was a convenient method of lubricating the cross-head in a more simple manner, and we obtained no higher price for our engine on this account.

R. D. Q. 6. The sixth patent in this "Defendants' Bound Volume of Patents" is No. 321,727, dated July 7, 1885. State what added value or benefit, if any, this device gave to your engine structure.

A. This patent was for a new method of securing the cross-head pin in the cross-head. It was used but a short time and proved of no special value, and its farther use was abandoned.

R. D. Q. 7. The seventh patent in this "Bound Volume
200 Exhibit" is No. 322,723, dated July 21, 1885, for an improvement in valve indicators. What position or value did this device have in your engine structure?

A. This device had nothing to do with the regulation or governing of the engine and was not regularly placed on our engines, but was only used when specially ordered and had a fixed additional value when applied to the engines. Its object was to indicate the point of cut-off for the amount of steam entering the cylinder at each stroke of the engine when the engine was in motion.

R. D. Q. 8. The eighth patent in this "Defendants' Bound Volume Exhibit" is No. 343,032, dated June 1, 1886, for an improvement in valve indicators for steam-engines. State what added value, if any, the devices of this patent gave to your engine structure and the relation of such devices thereto.

A. This was merely an improvement on the valve indicator patent last referred to and had nothing to do with the regulation of the engine, and was only applied to the engine when especially ordered at an additional fixed price.

R. D. Q. 9. The ninth patent appearing in this "Defendants' Bound Exhibit" is No. 360,594, dated April 5, 1887, for an improvement in steam-engine valves. What added value or position do the devices of this patent have in your engine structure?

A. This patent had nothing to do with the governing or regulation of the speed of the engine different from the valve that was first adopted, and has always been used in the construction of our engines and shown in patent 319,261. It was designed especially for giving higher economy in the use of steam, and was only used on a few engines within the last year especially ordered.

201 R. D. Q. 10. I call your attention to the tenth and last patent in "Defendants' Bound Volume Exhibit," No. 362,329, and dated May 10, 1887, for an improvement in water-escape devices for engine cylinders, and ask you what added value the devices of this patent gave to your engine structure, particularly as to its commercial value in the market.

A. The devices of this patent had nothing to do with the governing or regulation of the engine, its sole object being to prevent the engine from being damaged or broken by water entering the cylinder, being a simple device for that purpose lately adopted. All of these patents are subsequent to the patent in suit, and originated by reason of the perfect success obtained through the invention of my fly-wheel governor combination.

R. D. Q. 11. In answer to X Q. 38, which is as follows, "There are no means shown in the drawing, are there, by which the tension of the springs can be regulated"? to which you answered, "There is not," what drawing of your patent was your attention then called and to which this answer refers?

A. My attention was called by defendants' counsel in connection with that question to drawing figure 1 of my patent, and my answer was made solely to that drawing, and in a subsequent question I explained that figure 3 of my drawings did show the device by which the tension of the springs could be regulated and adjusted.

Recess.

R. D. Q. 12. At the end of your answer to X Q. 40 you state as follows: "The drawing shows the end of the spring hooked through the lug, which is not a mechanical way of attaching it and it
202 was never attached in that way." As I now recollect, you stated in a subsequent answer that you had made a few of your engine-governor devices with the end of the spring hooked through the lug. What do you desire to be understood as to this apparent contradiction?

A. I did not intend to say that I had never built an engine with the spring hooked through the end of the lug in that way, but intended to say that I never made a practice of building engines in that way; as I afterwards explained, I had built a few of my first engines with the spring hooked through the end of the lug, as shown in figure 1.

R. D. Q. 13. In this Buckeye engine catalogue in the passage quoted by you in addition to the quotation made by defendants' counsel made therefrom what do the words mean "but when the load is destitute of momentum or *vis viva* and is subject to great and sudden changes it may be necessary to adjust for a greater variation, according to the nature of the load"?

A. It means that it is necessary to adjust the springs at lower tension and below their full theoretic initial tension in order to obtain stability in the action of the governor, which means that it is necessary to sacrifice close regulation in order to obtain the proper action of the governor and prevent jumping or pounding. In other words, it means the greater the variation in load the farther away from equilibrity and isochronism they are compelled to adjust the governor.

R. D. Q. 14. What is meant by the word stability as applied to a governor?

A. It means the absence of sudden movement of the weights from

their proper orbits and the absence of the flopping about of the weights or their jumping or pounding.

203 R. D. Q. 15. Please state for the information of the court briefly and concisely what is the principal difference between the governing mechanism as identified by the claim of your patent in suit and the regulation devices contemplated by the descriptive matter on pages 36 and 37 of the Bucheye engine catalogue.

A. The principal difference is that my governor is equilibrious and isochronous under all conditions of changes of load and varying steam pressures; or, in other words, the springs are set at their full theoretic initial tension and the needed stability is obtained by the dash pot, the result being uniform speed of the engine and perfect regulation notwithstanding any changes of load and without regard to the momentum of machinery driven. The Buckeye governor is not equilibrious or isochronous and the greater the changes in its load or the lighter the machinery it drives the farther from equilibrity they adjust it. This departure from equilibrity is their means of obtaining stability. As a result the Buckeye governor is not isochronous or regular in its speed under change in load. The quotation from this Buckeye engine catalogue, on pages 36 and 37, recognizes this fact and points it out more clearly than I can express. This statement from this catalogue also bears me out and proves everything I have said regarding the Hartford Carpet Company and manilla company's engines.

R. D. Q. 16. Please examine "Complainant's Exhibit Defendants' Full-size Dash Pot and Spring" and state who made it or directed its construction as here present and for what purpose said spring was made.

(Counsel for defendant- states that while the question is ob-
204 jectionable as not redirect examination it has been agreed that this examination may contain such matter relating to that exhibit.)

A. The dash pot was made in my works at Springfield from a pencil sketch which I made from a dash pot in a Ball-engine governor in the Lake View Electric Light Company's station in Chicago, at which time I also took a sketch showing the proportions, dimensions, and size of the spring which was in the piston rod of the dash pots in those engines. The spring was made by the French Spiral Spring Company of Pittsburg, Pennsylvania, from a blue print which showed the dash pot and the spring and a portion of the governor. This blue print was sent to my attorney by the Ball Engine Company, and the spring is correct in its sizes, dimensions, and proportions as compared with the blue print and the springs which were in the governor of two Ball engines which are in the works of the Lake View Electric Light Company, Chicago. The dimensions or size of those engines, I believe, was twelve inches diameter in cylinder by twelve-inch stroke, rated at about seventy-five horse power, and running two hundred and seventy-five or three hundred revolutions per minute.

(Counsel for defendants desires to enter an objection to all testimony relating to this exhibit on the ground that it is not rebutting evidence.)

R. D. Q. 17. When were those dash pots with springs like this exhibit put in those Lake View engines, to your knowledge?

A. About May, 1887, to my knowledge.

R. D. Q. 18. What practical difference, if any, is there between the tension or resisting power of the spring of this exhibit and the spring of the dash pots of the Lake View engines near Chicago?

205 A. There could be no appreciable or practical difference in their power of resistance.

R. D. Q. 19. Please state what effect, if any, the introduction of this spring into defendants' dash pot or its incorporation therein in connection with or as a part of the piston rod has in the practical operation of defendants' dash pot, as one of the elements of defendants' fly-wheel-governor mechanism, and give your reasons for your statements or conclusions, enforcing the same by any tests you have made in confirmation of any facts you state.

A. The only possible effect the spring could have is to increase the friction of the piston rod and piston in its movement, on account of the great weight of the spring under the centrifugal force when the engine is in motion. This would have a tendency to prevent the quick and free action of the dash pot. It does not and cannot perform any other function or make any change in the operation of the dash pot or the governor to which it is attached, for the reason it is so rigid and unyielding that it would not act to any perceptible or appreciable extent under any pressure that could possibly be brought to bear upon it in the action of the governor under wide and sudden changes of load and varying steam pressures. The reason I am positive the spring cannot and does not act as a spring is because a pressure of four or five pounds will cause the dash pot to act freely, causing the glycerine with which it is filled to pass through the whole in the piston from one end to another. This assertion can readily be tested by hand movement on the exhibit itself. Now, any mechanical engineer can readily ascertain by well-known rules or tables in standard works the amount of pressure or force that would be brought to bear on this piston rod

206 under a sudden variation of any number of revolutions or change in the speed of the engine, and they will find that even under an instantaneous change of ten revolutions of the engine, which would be entirely inadmissable in practice, that the pressure on the spring, even if the dash pot did not act at all, would not exceed twenty-five pounds, but it would be an utter impossibility to maintain a pressure of twenty-five pounds on the piston rod for one second without causing the piston to move and prevent the action of the springs, so that under no circumstances could a pressure of twenty-five pounds be exerted on the spring; but even admitting that the dash pot did not act at all, the spring would not act or be compressed or extended perceptibly or appreciably under this

pressure; consequently it could have no effect on the action of the dash pot or the movement of the valve of the engine. For the purpose of knowing positively and that these statements are absolutely true, I have tested this spring by placing it endwise on the platform on a pair of Fairbanks' standard scales and applying a screw to the opposite end of the spring until the spring was compressed one thirty-second of an inch. I then moved out the weight on the scale beam until it balanced and recorded the pressure on the spring at forty-five pounds. I then compressed the spring beyond its initial position one-sixteenth of an inch and moved out the weight on the scale beam until it balanced, registering eighty-four pounds. I then compressed the spring from its initial position one-eighth of an inch, and when the scale was balanced it registered one hundred and sixty-four pounds. I then compressed the spring from its initial position one-fourth of an inch, put on additional weights on the scale beam until it balanced and
207 registered 329 pounds. Mr. Pearson, one of the witnesses in this case, also tested one of the springs in the piston rod of the dash pot in one of those Ball engines at the Lake View Electric Light Company, Chicago, which test corresponded very nearly with the test I have given, and that spring corresponded in size exactly with the spring of this exhibit. This test clearly shows that it requires eighty-four pounds to compress this spring one-sixteenth of an inch, which is the least amount that would give any perceptible effect on the movement or travel of the engine valve. Besides, it is clearly evident to any person that it would be impossible to put or maintain a force of eighty-four pounds on this spring for an instant on account of the piston moving freely in the center under a pressure of five pounds. As before briefly stated, in my opinion the spring is a serious objection on account of its great weight, which has increased several times its normal weight under the action of centrifugal force, thus crowding or springing the rod out of line and causing the piston rod and connections to bind on their bearings.

R. D. Q. 20. What effect would it have if the spring, as shown in the exhibit and in defendants' governor, were made of sufficient weakness or resiliency to respond to the movements of the levers and weight mechanism before any movement of the dash pot?

A. It would have the effect of defeating the objects sought to be obtained by the use of the dash pot and set up a vibration and jumping or pounding of the governor weights. In order for this spring to operate or have any appreciable effect as a spring it would have to be weak enough to compress or yield to the extent of one-
208 eighth of an inch under a pressure of from five to ten pounds, and that would be very many times weaker than the spring in the exhibit.

R. D. Q. 21. I call your attention to a careful consideration of the patent of one of the defendants, Mr. Ball here, and ask you, after perusal of said patent, if your conclusion or statement as to any opinion or fact is changed by any matter or thing appearing in said patent.

A. I have read and examined the Ball patent, number 358,829,

and think I understand it fully and the objects thereby sought to be obtained, but the facts stated by me show the theory of the patent to be delusive. The only merit, evidently, of the Ball patent lies in its containing the elements of my invention covered by my claim, and that the interposition of the alleged spring is merely a subterfuge to escape my patent.

Recross-examination by J. K. HALLOCK, Esq.:

R. X Q. 1. Please look at your model, "Complainant's Exhibit Complainant's Governor," and give me the size or dimensions of the dash pot complete on an engine of the same dimensions as the Ball engine you have named as being at the Lake View Electric Light Company.

A. I don't build an engine of the same dimensions and proportions as the Ball Engine Company, but one of my engines equal in power to that size would be twelve inches diameter cylinder by eighteen-inch stroke, rated at eighty horse power. The dash pot used on that size engine is about two inches in diameter inside of the cylinder and about nine inches long, including the stuffing box, and the piston has a travel of four or five inches, the piston rod being seven-sixteenths of an inch in diameter and the piston head about one inch thick.

209 R. X Q. 2. Does the piston in your dash pot fit so closely as to preclude the passage of fluid between it and the cylinder as it moves in the cylinder?

A. It is made to fit as close as possible without causing friction. Probably a little glycerine passes between the piston head and the cylinder, as there is no packing used.

R. X Q. 3. What is the total area of vent opening in your piston?

A. I never figured the exact area. We usually put in one hole, size three-sixteenths of an inch in diameter. Where very quick action of the governor is required in throwing on and off the engine heavy loads, we put two holes through the piston head, each three-sixteenths of an inch in diameter, and sometimes vary the size of the holes a little for special requirements.

R. X Q. 4. The degree of resistance offered by the dash pot depends, does it not, first, upon the sizes of the piston as to diameter; second, as to area of vent opening, and, third, as to how close a fit the piston is within the cylinder?

A. It does; entirely so.

R. X Q. 5. How much resistance will a dash pot offer which has a piston which fits absolutely tight—that is, so it won't leak—which is two inches in diameter and has a vent opening one-sixteenth of an inch in diameter?

A. The amount of resistance will depend entirely upon the consistency of the glycerine and the rate of speed or rapidity at which the power is applied. If the power was applied slowly the resistance would be light. If it was applied quickly or rapidly the resistance would be great.

R. X Q. 6. Well, now, let us get at it in this way: We have
210 a dash pot with a piston two inches in diameter and it is supposed to fit so as not to leak, and it has a vent opening one-sixteenth of an inch in diameter, and the glycerine is of the same consistency as that you use. How many pounds of force will it take to move that piston a half an inch in one-fifth of a second?

A. I don't know and can't approximate it, but it would burst the cylinder if sufficient power was applied to move it that distance in the length of time named. It would require a power of several hundred pounds or perhaps several thousand pounds, but the force applied to the dash pot through the action of the weights in both the Ball engine and my engine is never sudden, but is applied gradually. It would be impossible to bring a sudden force on the spring or dash pot such as is referred to in the question, because it requires a great change in the speed of the fly-wheels, and on account of their great weight and high velocity this change cannot occur suddenly, even under the most extreme changes of load possible, on account of the great inertia stored in the revolving fly-wheels.

(Counsel objects to all that part of the answer beginning with the words "but the force applied to the dash pot" as not responsive.)

(Counsel also objects to that part of answer to R. D. Q. 19 which refers to experiments made by Mr. Pearson as not proper evidence.)

ALBERT L. IDE.

Subscribed and sworn to this 1st day of August, A. D. 1888, before me—

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

Adjourned to Thursday, Aug. 2, 1888, 10 o'clock a. m.

211 THURSDAY, *Aug.* 2, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.

Present: Same as before.

And thereupon complainant's counsel calls as a witness in its behalf Mr. MELVILLE E. DAYTON, who, being by me duly sworn to state the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by Mr. C. K. OFFIELD:

Q. 1. Are you the same Melville E. Dayton who has heretofore been sworn and testified in this case?

A. I am.

Q. 2. Have you read the depositions given in this case on behalf of the defendants by Joseph W. Thompson, Harris Tabor, Edward H. Schneider, F. H. Ball, Wm. Steele, and Gardner Sims, so that you understand the same and all mechanisms and exhibits described by them and identified by their exhibits respectively as a part thereof?

A. I have.

Q. 3. Has any statement of opinion or conclusion or statement of fact expressed by you in your deposition *prima facie* been altered or changed in the least, either as to the scope, construction, or validity of the complainant's patent in suit or the defendants' infringement thereof, by reason of any matter or thing appearing in such depositions or the identified exhibits therewith?

A. There has not. On the contrary, the opinions and conclusions which I had reached and have expressed in the said *prima facie* deposition have been confirmed by the said defendants' depositions and the exhibits identified therein. By said defendants' exhibits
212 and testimony I am also confirmed in the conviction that the said Ide invention is one of clearly marked character, wholly novel and of great value. Said defendants' testimony and exhibits serve, to my mind, to bring out these features of the Ide invention in bolder relief by the contrast therewith which they present of expedients and make-shift attempts to remedy inherent faults of crude and clumsy constructions; which attempts, while they prevented absolute wreck and disaster, produced none of the distinctive results and in no degree the perfection of operation which Ide aimed at and achieved in his said invention.

Q. 4. I call your attention now to the exhibits introduced in evidence under the deposition of defendants' witness, Mr. Joseph Thompson, marked "Exhibits A" and "B," being a blue print of an alleged drawing of an alleged Buckeye governor and an alleged model of the same, and ask you whether or not "Exhibit B" is substantially a correct representation of "Exhibit A," and whether or not it is made to any scale established by said "Exhibit A," or is a fair presentation to the court of an accurate model as to proportion and construction of said "Exhibit A," and give your reasons in this connection.

A Exhibit "B" is not a correct representation of the structure shown in "Defendants' Exhibit A," but is so distorted in proportions as to give a wholly mistaken idea of the size of the wheel relative to the engine, a part of the shaft of which is present therein. The drawing, "Defendants' Exhibit A," is drawn on a scale of three inches to one foot, which calls for an engine main shaft one foot in diameter and would make the entire wheel five feet in diameter. Assuming the shaft in the "model, Exhibit B," to be
213 one foot in diameter, the entire diameter of said wheel would be about twelve feet, or about twice and a half the diameter that it should be if made to the scale shown in "Defendants' Exhibit A;" or, stating the fact otherwise, if the "model wheel, Exhibit B," were made in the same ratio to the shaft in said wheel that the wheel in drawing "Exhibit A" bears to the shaft in said drawing, then the wheel of the model would be only about an inch larger in diameter than the small eccentric disk which is on the end of the shaft in said model. In the drawing "Exhibit A" there are no weights shown, while weights are present in the model. The springs in the model are not as heavy in proportion as they are represented in the drawing. The drawing is a side view of a wheel, and while it shows the rim projecting towards the eye from the plane of the

wheel arms, it is not possible to determine from said drawing whether said wheel arms connect with the rim at the further edge thereof. I understand from the testimony relative to the construction of Buckeye governors that said drawing "Exhibit A," is supposed to represent had their rims invariably offset or attached at one edge to the wheel arms. In the "model, Exhibit B," the wheel arms are attached to the rim in its median line. The effect of these departures by the model from the proportions and construction actually present in the Buckeye governor represented in the drawing tend to give to said model the proportions and appearance, when viewed cursorily, of a fly-wheel as distinguished from a mere shaft governor disk or wheel, which was all that the drawing "Defendants' Exhibit A" purports to represent. I think these departures from the drawing should be borne in mind, because, being entirely unnecessary, they are calculated to mislead, particu-
214 larly in view of the adoption in said model of substantially the same proportions of shaft and wheel which are present in the models of "Complainant's Exhibit Defendants' Governor" and "Complainant's Exhibit Complainant's Governor," which are made to scale.

Q. 5. Please examine "Complainant's Exhibit Complainant's Patent," being the patent in suit, again carefully and state what kind or distinctive species of mechanism appears in that patent in connection with the governor and dash pot, give your reasons for your statements, and state whether or not any ordinary mechanic skilled in the art would have the slightest difficulty in recognizing the character and purpose of such mechanism or wheel from the information alone furnished by said patent.

A. The wheel with which the governor devices and dash-pot are combined is clearly shown to be a fly-wheel and pulley combined; that is to say, a wheel of such diameter with respect to the diameter of the shaft on which it is mounted, and having such great weight in its rim as to serve as a fly-wheel in a technical sense of those words, and also having such width of rim as to enable it to serve as a pulley for driving a belt.

The character of the wheel thus perfectly plain from the drawings is also clearly stated in the specifications. No mechanic could for a moment mistake the character of the wheel to be other than that above stated. The drawing shows the further characteristic of a fly-wheel in the strength or size of the wheel arms and their disposition in the wheel centrally to the hub and rim.

At line 12, page 1, the patent says: "This invention relates to that class of steam-engine governors known as fly-wheel gov-
215 ernors." The claim of the patent also says: "In a fly-wheel governor, the combination," etc. Elsewhere in the specification it is referred to as a governor wheel or pulley, which terms are entirely consistent with its character as a fly-wheel, because, as I have pointed out, the wheel is both a fly-wheel and a pulley. The drawing of this patent was made to a scale, being reduced proportionately from a blue print of working drawings furnished me by the inventor, Ide, at the time the application was prepared.

Q. 6. You have stated that you have read the depositions of defendants' witnesses given in this case. Now, for absolute certainty of understanding and convenience of reference, please state exactly what you understand to be the described mechanism located upon the shafts of the old engines described by the witnesses, containing a governor and dash pot, more prominently relied upon and described by defendants' witnesses as being employed upon the Buckeye engines of the Hartford Carpet Company and Hartford Manilla Company, at Hartford, Conn., and upon the engines at Dow's stores, at Brooklyn, N. Y., and the engine at the Syracuse iron works. Then please state whether or not you find the inventions of the relied upon patent in suit, as expressed and identified by the claim, to be contained or suggested by any of these old alleged instances of use of shaft governor and dash pot, and give your reasons fully and completely as to your conclusions or opinions in this matter.

A. From a careful reading of the several depositions relating to these various engines and their governors, I find that said governors do not and did not contain or suggest the invention of the Ide patent and claim sued on. They were in every instance of the old
216 patented form of shaft governors, known as the Buckeye governor. The governor in all these cases was entirely independent of the fly-wheel and occupied a different place upon the crank shaft of the engine from the fly-wheel. In addition to the movable levers, weights, and springs, said governors comprised each a disk having a marginal rim, offset wholly at one side of the disk, and forming a casing or housing for the weights, levers, and springs, with one difference as to the Manilla Company engine, to wit, that the disk of the Manilla governor was made open or with holes and arms, instead of in the form of a continuous circular plate. These governor casings bore no resemblance whatever to a fly-wheel in either size, disposition of metal, strength, and in rigidity of their relative parts or mode of connection to the shaft, and they therefore lacked both the characteristics and functions of a fly-wheel or fly-wheel pulley. Each of the engines had a fly-wheel in addition to this governor casing, and the relative proportions of the two, as stated by the witness Schneider, for example, concerning the Dow's store engine, clearly illustrates this fact. In that engine the governor casing weighed only about five hundred pounds, as against thirty-two thousand pounds weight in the fly-wheel, while the diameter of the governor casing was only about or less than a fourth of that of the fly-wheel. By reason of this difference in diameter, moreover, the weight in the governor casing, even if all of it were located in its rim, would be, pound for pound, less than one-fourth as effective as in the rim of the fly-wheel, where the principal and effective weight is located. It follows that it would take two hundred and fifty-six of such governor casings, if each had all its metal located in its rim, to give the effectiveness of the single eighteen-
217 foot fly-wheel of the engine, or, as the weight of said governor casing would be perhaps about equally divided between its rim, hub, and disk, with proportionate reduction of effectiveness in the parts nearer the shaft, it would take probably about a thousand

of these disks or casings on the shaft to give the same momentum that is obtained by the single eighteen-foot fly-wheel. This, of course, is absurd. The lengthening of the shaft and the burdening of the same with such a string of disks would create so much weight and friction on the shaft as to practically defeat the operation of the engine or would, at least, tax it to its full capacity and render it incapable of doing any other work. It is therefore quite evident that these old Buckeye governors were not "fly-wheel governors" and therefore did not answer to the terms of the Ide patent and claim, which distinctly specifies that the patented invention relates to and is contained in a fly-wheel governor.

A further and fundamental difference between these old Buckeye governors, referred to in the question, and the fly-wheel governor containing the Ide invention lies in the fact that they were entirely wanting, both before and after the dash pot was applied thereto, the prime characteristic of equilibrity and isochronous action, or, in other words, they did not contain balanced forces of weights and springs and could not give or have uniform speed under varying loads or varying steam pressure. That is true of the most successful Buckeye governors, and these particular governors to which the dash pot is said to have been applied are admitted to have been particularly bad governors of that kind. They were so bad that the engines having them on couldn't be run without destruc-
218 tion, as admitted by all the witnesses who testified concerning them. They were "sick" or "cranky" cases. One of the witnesses, to wit, Mr. Harris Tabor, in answer to Q. 18, printed page 17, of Defendants' Record, says, concerning the Hartford Carpet Company's engine, "We had a case of what is commonly called racing of governor," just as a physician would say he had a case of the rickets. He says he took the foreman of the machine factory with him and attempted to correct the trouble, but was unsuccessful—that is, they tried to cure the sick governor and couldn't do it. After their failure they decided to try a dash pot and did so, with the effect, as stated by another witness, Mr. Hoffman, of enabling the engines to be run without dashing themselves to pieces and well enough to enable the builders to get their pay for the engines. There is not only no evidence going to show that these old Buckeye governors was or were capable of being made equilibrious or balanced as to their centrifugal and centripetal forces, but it is in proof that the contrary is true, while, by "Defendants' Exhibit Buckeye Catalogue," under the heading "good regulation," pages thirty-six and thirty-seven, it appears that even the improved form of this governor last put forth is admitted to be destitute and incapable of such equilibrity and consequent isochronism. It has been pointed out fully in my *prima facie* deposition and in the deposition of Mr. Ide, that the governor containing his invention possesses equilibrity or balanced forces of weights and springs, and that it is with this character of governor in a fly-wheel of fly-wheel pulley that he has combined a dash pot, the direct function of the dash pot being to give stability to the governor and thus make an equilibrious gov-

ernor practicable and resulting isochronism possible. These
219 old Buckeye governors, not being equilibrious, do not by the mere addition of a dash pot become the isochronous governors of the Ide patent, and they therefore did not contain the claimed Ide invention concerned in this suit.

It is undoubtedly true, as alleged by the various witnesses for defendants, that the dash pots which they resorted to in doctoring these old "sick" governors obviated the violent irregularities of said governors and prevented them from hammering themselves to pieces, so that in one sense of the word said dash pots lessened the unsteadiness of the governors and enabled them to give "better regulation" than they had given previously, when it appears they ran so badly that it was not safe to run them at all; but there is nothing in the evidence of said witnesses to indicate that the governors, after the application of the dash pots, were capable of giving that nice and highly perfect regulation which is shown to have been attained and is alleged in his patent to be attained by the Ide invention. At this point it is to be borne in mind that the Ide invention was stimulated by a demand for a nicer regulation than had ever been attained in steam motors, such demand growing out of the new art of electric lighting and the fact that in incandescent electric lighting the defects of the best regulation theretofore attained in engines were manifested in the highly objectionable irregularity or fluctuation of the electric lamps. For such work isochronism of the engine, which had before been regarded as desirable, but had been admittedly unattainable (because it had been impossible to use an equilibrious or perfectly balanced governor), became a necessity. It is this sort of steadiness and perfect regulation to which reference is had in the Ide patent, where he directly refers to the de-
220 mands of electric lighting and not the rude and imperfect regularity referred to by witnesses in describing these old "sick" Buckeye governors that were doctored with a dash pot. It is not said of any one of these old structures that with a dash pot they ran any better than other Buckeye governors without the dash-pot, but it appears from Hoffman's testimony, as to all of them of which he had knowledge, that they ran with only tolerable regularity, sufficient to enable the builders to demand their pay. It is therefore evident that the application of the dash pot to these "sick" or unusually defective governors made them no better, at least then the average or ordinary Buckeye governor, and there was hence nothing in these exceptional uses of the dash pot to produce or suggest the invention and combination of complainant's patent or the novel and highly valuable results obtained thereby.

As going to show the entire accuracy of my foregoing statement as to the lack of equilibrity in the old Buckeye governor and its consequent failure to present the Ide combination and invention when the dash pot was added thereto in those instances adduced by defendant, I here quote the third paragraph from page 27 of "Complainant's Exhibit Buckeye Engine Catalogue:" "The auxiliary springs 'P' 'P' were introduced a few years ago to obtain the refined closeness of regulation required for electric lighting. For

reasons that we have not space to explain, the amount of tension required to give the closest possible regulation could only be carried while the arms were in the outer half of their range of movement. In the inner half it would be in excess, causing unsteadiness. The auxiliary springs tend to throw the arm outward, but act only through the inner half of movement range, leaving
221 contact with the fingers on which they act in mid-movement." The auxiliary springs "P" "P" mentioned in the above quotation are shown in the drawing on the opposite page as bearing at their free ends against short arms on the weight levers *a a* and as exerting their force to start the heavy weights A A outward. In the fifth paragraph, page 27, it is said of them "that they shall have just sufficient force to start the arms out at very nearly the proper speed, and, 3rd, that they shall leave contact at about mid-movement"—that is to say, those auxiliary springs P P act in aid of the weights in the first part of the latter's outward movement. (Mr. Ide has explained why in his deposition.) To say that the amount of "tension" (quoting now from the first above quotation of the catalogue) "required to give the closest possible regulation could" prior to the introduction of these auxiliary springs "only be carried while the arms were in the outer half of their range of movement" is to say, in plain words, that the old Buckeye governor wanting these springs, or, in other words, the Buckeye governor of these various instances wherein they were doctored by the dash pot, "could only have a required tension of the springs for the outer half of their range of movement." For the inner half of their range of movement they must have had a much less tension, for the reasons explained by Mr. Ide, and even then the tension of these springs was so much too great for the inner half of the range of movements of the weights A A that these auxiliary springs P P were added to aid the weights in the first half of their outward movement in opposition to this extremely low initial tension of the main springs F F. There was therefore the
222 widest possible departure from equilibrity in this old Buckeye governor confessed by these statements of the Buckeye engine catalogue. These auxiliary springs may be regarded as the remedy for the defects of the old governor, which are preferred by the Buckeye Engine Company, and, inasmuch as they are the direct reverse of the dash pot in their action, and as Mr. Thompson, who is the inventor of the Buckeye governor and superintendent of that company, had deposed for the defendants that his company has never put on a dash pot, it seems to me plain that Mr. Thompson recognizes the fact that the dash pot does not when applied to a Buckeye governor give "good regulation."

Adjourned to Friday, Aug. 3, 1888, 10 o'clock a. m.

FRIDAY, *August* 3, 1888—10 o'clock a. m.

Parties met pursuant to adjournment.
Present: Same as before.

Examination of Mr. DAYTON resumed:

But, returning to the point, not only is the fact here plainly admitted that the springs F F were not in balance with the weights A A of the old Buckeye governor through at least half their movement range, but it follows from this plainly admitted lack of balance that there was in said governor no equilibrity or isochronism for the remaining or outer half of said movement range because springs which are initially under so far less tension than the weights in their inner position must, if they reach or approximate the centrifugal force of the weights at all at any point, have a more rapidly increasing resistance or tension than the increase of centrifu-
223 gal force of the weights. It is absolutely sure, therefore that these old Buckeye governors were not, and were not pretended to be, equilibrious and isochronous. The conclusion certainly follows that the introduction of a dash pot into these old unbalanced Buckeye governors did not make the combination and invention and did not produce the structure or results set forth and claimed in the Ide patent sued on.

The model, "Defendants' Exhibit B," shows that the old Buckeye governors into which the dash pot was introduced was the construction of Buckeye governor before these auxiliary springs P P were applied, as shown by Buckeye engine catalogue, and therefore had the defects and particularly the lack of equilibrity which said catalogue admits and points out.

Q. 7. Defendants' counsel, in his cross-examination of the complainant Ide, professed not to understand that you had testified or had intended to testify in your *prima facie* deposition to the end and effect that the invention of Mr. Ide resided in and was expressed by the combination of a fly-wheel or fly-wheel pulley, governor, and dash pot. Is there the slightest uncertainty as to this matter? And please now express yourself so positively that there can be no room for doubt or criticism upon the part of defendants' counsel as to this matter.

(Counsel for defendants objects to the question on the ground that the complainants have no right to amend their *prima facie* case by qualifications or explanations. It is for the court to say what the deposition of the witness in the *prima facie* case says.)

A. I find nothing whatever that is dubious on this point
224 or that would properly justify a question by defendants' counsel as to the meaning of said deposition concerning this matter. In the first part of my answer to Q. 4 in said *prima facie* deposition, when asked to state what I understand the Ide invention to be, I not only quoted the claim, which distinctly says that the combination exists in a fly-wheel governor, but in the next following sentences I pointed out that the drawings and description set

forth "a fly-wheel of a steam-engine," and that certain parts were pivoted "to the arms *a* of the fly-wheel," spoke of the rotation of the fly-wheel, and to the attachment of the moving parts of a "fly-wheel," and, in short, continued to refer to the "fly-wheel" right along throughout the deposition. At one point of this answer I used these words: "The invention consists, for any or all the purposes which it is adapted to accomplish, in the combination stated in the claim already quoted," which claim I here again quote: "In a fly-wheel governor, the combination, with relatively movable parts, of a dash-pot, substantially as described," and in each of the two following and concluding sentences of said answer I specified the fly-wheel by name.

The patent is, moreover, perfectly explicit on this point. First, it says that the invention relates to that class of steam-engine governors known as fly-wheel governors. Next it says "that the invention consists in the combination of a dash pot with the governor and pulley," the fly-wheel shown in the drawing being also a pulley. Describing the drawings, which unmistakably show a fly-wheel pulley, the patent says: "A is a pulley or wheel having arms *a a* and secured by its central hub to the shaft B." There is not a word in the specification which points to any other wheel than this fly-wheel pulley, while the claim already quoted starts out with the statement that the combination covered by said claim is embraced "in the fly-wheel."

225 Q. 8. You have in your testimony, *prima facie* and present, frequently used the word or term "stability," "equilibrity," and "isochronism" in discussing and stating the invention of this Ide patent. Will you please state somewhat precisely the relation and effect with which you used these terms in connection with the Ide invention or the general art to which it belongs?

A. Equilibrity in a governor is that state or condition of the governor in which the centrifugal force of the weights balances or equals the centripetal forces of their opposing springs at all points in the range of movement of said weights. Such equilibrity is obtained either by the original selection or by the adjustment of the springs to this end. To obtain equilibrity the springs are selected or adjusted to have a tension which draws inwardly against the weights when the latter are at their innermost position with a force equal to their centrifugal force in this position, and which increases in its tension in the same ratio that the centrifugal force of the weights increases at the several points in their outward range of movement. Such springs are said to be of full theoretic initial tension.

Stability in a governor is steadiness in the movements of the governor weights as they vary in their radial position under changes of load, so that their radial movements are only such as are proper or are due only to such changes in load or steam pressure. Stability is a relative term, and may in one case mean absolute obedience of the weights to the influence of change of load, and in another case may mean approximate steadiness or only tolerable regularity in the movements of the weights. Instability may result from various

causes. In an equilibrious governor, or one in which the
226 movements of the steam valve are sought to be determined by an equilibrity or balance forces of the weights and springs, instability is a direct result of such equipoise of centrifugal and centripetal forces. Also an equilibrious governor is especially sensitive to the action of gravity of the moveable parts of the governor and to the momentum of a reciprocating valve connected with the governor. To give stability to such an equilibrous governor will be not only to counteract the inherent tendency of such a governor to instability, but to counteract the influences of the gravity of certain moving parts, the momentum of other parts which reciprocate friction between all moving parts and any other disturbing forces present, to which, as stated, an equilibrious governor is peculiarly sensitive.

Isochronism is a term applied to the action of an equilibrious governor to which stability has been imparted. It means that the governor has a uniform speed or the same number of revolutions in each of several equal periods of time, and has special reference to this uniform action when the engine is subject to changes of load, which have a tendency to disturb or prevent such uniformity of speed.

While prior to the achievements of this Ide invention, in this suit, equilibrity and isochronism were known as desiderata only, they are now known and spoken of as accomplished facts, said Ide invention and combination being the first, so far as I am aware, by which stability was imparted to an equilibrious governor and isochronism in action thereby obtained.

Q. 9. Calling your attention again to "Complainant's Exhibit Defendants' Fly-wheel Governor," I will ask you if there is anything
227 in that mechanism which eliminates the tendency of certain extraneous forces which are calculated to disturb the movements of the valve when the engine is in motion.

A. There is not. In said defendants' mechanism there is employed a secondary eccentric and a pin projecting from said secondary eccentric into the arm which suspends the main eccentric by which the steam valve is controlled. This construction in some measure, but by no means wholly, counteracts the forces of gravity, momentum, and friction of the moving parts referred to in the question. This peculiar construction increases somewhat the internal friction of the governor and, to this extent, opposes the disturbing forces referred to, but it does not meet them entirely, and said disturbing forces are the same in kind as and only less in degree than in the governor of complainant's patent, to which the question refers.

In this connection I wish to refer to my answer to X Q. No. 10, which is a less full and clear statement than the foregoing of the actual fact, although in said former cross-answer I did distinctly say that the eccentric of defendants' governor was not "locked." If necessary to be so used, I desire the present answer to be regarded as a correction or explanation of my said former cross-answer.

(Counsel for defendant- objects to the question and answer as a re-opening in its nature.)

Q. 10. In answer to X Q. 22 and 23, your former deposition, you state that there is no description in the Ide patent of means by which adjustment of the springs and weights is effected. Please explain how it happened that your answer was given in that way and whether on an examination of all the drawings of said patent such information as to adjustment is present.

228 A. The first of these cross-questions asked me to "point out in the specification whatever language there is which would teach a person how to balance the centrifugal and centripetal forces of a governor by the proper adjustment of the weights and springs." Looking at the text of the specification alone, I found no such language, and, without examining the drawings of all of them, I replied broadly that there was nothing in the patent which attempts to give this information, adding all that was a common knowledge in the art. I have since found by a fuller examination of the drawings, and particularly figures two and three thereof, that means are shown in the drawing of the patent by which the tension of the centripetal springs F F may be adjusted as to their tension. Such means consist of a lug which is attached as a separate piece to the hub of the fly-wheel for connection with the inner end of each of the springs F, said lug having a plurality of holes, as indicated in figure 3, by which a screw-bolt may fasten said lug to the fly-wheel hub in either one of several positions.

I was less cautious in looking for an illustration of this device for the reason that I then regarded it and now regard it as wholly unimportant and immaterial, for the reasons, as stated at the end of my cross-answer No. 22, viz., that all of that was a common knowledge in the art. By this statement I meant and mean that the selection and the adjustment of springs to exert a required force or to meet and balance a required resistance was at the date of this patent a matter familiar to mechanics generally, and that it was not necessary to the completeness of this patent that well-known means for such adjustment of the springs be shown.

(Same objection as before.)

229 Q. 11. Defendants' counsel in his cross-examination of Mr. Ide attempts to cast doubt upon the statement that the element of the fly-wheel in the Ide combination of fly-wheel, governor, and dash pot is a part of the governing mechanism of that combination and a part of the governor. What have you to state as to this matter?

(Counsel for defendant- wishes to state to the witness before he answers the question that my position as to this matter is that the fly-wheel has the same relation to the governing parts as the chair you sit in has to a patent expert, viz., a support for the delicately balanced mechanism in each case.)

A. Counsel is manifestly wrong. The fly-wheel is clearly a part

of the governor. Why, in some engines the fly-wheel is all the governor the engine has, and the sole office of the fly-wheel in any engine is, as a fly-wheel, to govern or assist in governing.

(Question and answer objected to as reopening.)

Q. 12. I call your attention to "Complainant's Exhibit Full-sized Dash Pot and Spring" and also the Ball patent in evidence, marked "Defendants' Exhibit C," and ask you if the interposed spring appearing in that exhibit and disclosed by the patent can have any such effect as claimed for it in this Ball patent, and what effect, if any, the incorporation of that spring has in the dash-pot mechanism of the Ball patent.

(Objected to as reopening.)

A. In my opinion, based on the testimony relating to tests that have been made or based alone on the hand tests which I have been able to make with the device itself, the spring in the piston rod of said exhibit will not have the effect and action set forth in the Ball patent, and that it has no practical effect whatever that is
230 beneficial or otherwise than harmful in the governor containing said dash-pot mechanism and spring. In short, I wish to say that said spring and the dash-pot piston rod, when used in a governor, has no perceptible longitudinal spring action, and that it does not, therefore, modify the action of the dash pot from the action it would have in the absence of a spring or with a plain piston rod, but that said spring can bend laterally in the position in which Ball uses it, and that it therefore can and will lead to a binding of the piston and its rod in the cylinder and stuffing box, respectively, and to that extent will impair the natural and proper action of the dash pot itself.

It is to be borne in mind that the initial movements of a governor weights under a change in load upon the engine is necessarily very slow, for the reason that such movement can take place only by a change of the rotary speed of the fly-wheel, and this change in speed is of itself necessarily slow because of its weight. Imitating this slow movement of the weights by my hands, applied to pull out and push in the dash-pot piston of this spring exhibit, I find that the dash-pot piston moves under such hand strain without any discoverable yielding of the spring, and I find that such hand power necessary to move the dash-pot piston is very many times less than the power which the tests have shown to be necessary for the appreciable compression or elongation of said spring.

The statement of the action of this spring in the Ball patent is, on its face, absurd and ridiculous. Ball there states that when a change in load occurs the balls will promptly move out or in to their new position; that the spring alone will first yield to this movement, and that the dash-pot piston will then follow up
231 the spring. Now, it is a law of springs that they react against force applied to expand or contract them. Such reactionary force of the spring would as much tend to move the weights back from their new position as to move the dash-pot piston

towards the new position of the weights, and the spring would therefore, if it acts at all, tend to prevent the proper assumption of new position by the weights and occasion a disturbance rather than give stability to the governor. Springs which are attached to movable parts at both ends are not so obliging as to pull or push on one of these parts only. In my judgment, the fact is that the spring of this exhibit and of the Ball patent does practically nothing at all, and that it is substantially the same as a straight inelastic piston rod, leaving the dash pot as the only efficient thing by which the results, falsely attributed to the spring in the Ball patent, are accomplished. In other words, the dash pot and so-called spring piston rod of the exhibit and of the Ball patent are substantially the same, to all intents and purposes, as the dash pot and plain piston rod of the Ide patent and invention.

Q. 13. What will be the effect if the spring in this Ball dash pot has any yielding motion or quality at all in practical operation?

(Same objection as before.)

A. If the spring could yield instead of the dash pot, or, in other words, if this Ball actual construction were so changed that the spring would be relatively light and yielding and the dash-pot piston relatively hard to move, so that in fact the comparatively slow initial movement of the governor balls would stretch or compress the spring before moving the dash-pot piston, as alleged in the Ball patent, it is plain that the action of the contrivance
232 would be to induce a vibration of the governor weights or balls or a dancing movement of said weights, which would be highly objectionable; in other words, would positively give instability to the governor. This would occur for the reason I have already stated, namely, that the springs would react with the same force under which they first acted. If the dash pot held one end of the spring, while the weights moved the other end, from one position to another, it would also hold that end of the spring while the latter pulled or pushed the weights from their latter position to or towards their former one, and this back-and-forth movement or instability would continue with decreasing range of movement till the dash-pot piston finally moved to its proper place, where it would give no tension on the spring. If before this was done other changes in the load occurred, a new set of vibrations would be inaugurated, and by repeated changes of load there would with such a spring dash pot be kept up a constant instability of the governor and irregularity of the speed of the governor.

Q. 14. Assuming that the spring shown in connection with the piston stem of the dash pot of the Ball patent has no action and cuts no figure practically, state whether or not the mechanism described, the governing mechanism of fly-wheel, governor, and dash pot of this Ball patent or engine, is anything other or different in purpose, object, substantial mechanical construction, and result from the combination of a fly-wheel governor and dash pot of the Ide patent and claim, and whether or not the descriptive matter in the

Ball patent as to purpose and result would not apply equally as well to the invention of this Ide patent.

(Objected to as before.)

233 A. It is not anything other or different in substantial construction, object, purpose, and result from the invention and combination claimed in the Ide patent, and the description contained in the Ball patent of the objects and result therein set forth would apply equally to the object and result of the Ide invention.

Cross-examination by J. K. HALLOCK:

X Q. 1. In defining stability you speak of instability; do you understand instability to mean the same as what is commonly called "racing," when applied to the mechanism we have under discussion?

A. Racing is one form and degree of instability.

X Q. 2. Is it an intense degree of instability?

A. It is rather a particular form of instability involving an extreme movement in both ways of the governor weights, an outward movement succeeding an inward movement, and so on, giving an extreme or excessive vibration of the weights successively back and forth.

X Q. 3. Would not the words "wide and sudden radial movements of the weights" define racing?

A. It would, but the word racing is often loosely applied to other forms of irregularities than this particular form, which would be properly so designated.

X Q. 4. What would be the effect in the Ide governor if the dash pot was removed and the springs left at full theoretical tension? Would it race—would there be wide and sudden radial movements of the weights?

A. There would undoubtedly be wide and sudden radial movements of the weights.

234 X Q. 5. It was for the prevention of such wide and sudden radial movements of the weights, in the governor having its springs adjusted with relation to the weights so as to give equilibrium. That was the object of the Ide invention?

A. It was.

X Q. 6. And that object was accomplished by the incorporation of the mechanism of a dash pot, as stated in the patent, was it not?

A. By the incorporation of the dash-pot in an equilibrious flywheel governor, as set forth in the patent.

X Q. 7. Now you have stated that the defendants have shown that a dash pot was used in the Hartford Carpet Company's engine and others for the purpose of preventing racing, but as I understand your position you insist that these prior uses do not anticipate this invention of Mr. Ide's for the reason that it has not been shown that those engines were provided with governors which were adjusted to perfect equilibrium, but that they were "sick" governors

and had a very bad attack of racing, which you have called "rickets." Is that a fair summary of your position?

A. It is not a half strong enough statement of my position, which is that these old governors belong to a class and construction which their makers' own catalogue shows were not and could not be equilibrious; that these particular governors were more defective and rattle-trappy than the average; that they were doctored by a dash pot into merely tolerable execution; that after being so doctored they were no better than they should have been in the first place, by the same defective and non-equilibrious standard of that construction of governor; that they did not show any characteristics of an equilibrious governor, made stable and rendered capable of isochronous action, after the dash pots were added; that the Buckeye
235 Company, who made these governors, never themselves put a dash pot on even one of their sick and cranky cases; that they never learned that the dash pot was of any use to give good regulation, but was only a last resort for desperate cases, which could not be otherwise made operative, and that they did not and could not by the application of a dash pot to their non-equilibrious governor, sick or well, derive any hint or suggestion of the utilities and admirable regulating results obtained by the combination of the Ide invention.

X Q. 8. Then, as I understand it, your position is this: That although a very sick governor has been doctored by the injection of a dash pot, it was yet invention for Mr. Ide to doctor a governor which was constitutionally irregular by the injection of a dash-pot?

A. I should suppose my last answer would make my position plain. To restate it, in the spirit of the question, however, it is my opinion that the tinkering up of these old sick governors so that the engines could be run without ruin and without producing an equilibrious governor which was stable and which was therefore isochronous was no anticipation of the clearly conceived and successfully executed invention of a governor having different characteristics of structure, new possibilities, and capabilities of better regulation than any governor heretofore produced. It is a fact that an equilibrious governor, rendered stable by any means and capable of isochronous action, was unknown in the art prior to Ide's invention, and that such a governor had been greatly desired and sought after. Hundreds of patents have been taken out, many of them by defendants' witnesses in this case, seeking to improve the regulation of steam-engine governors. The defendant Ball has the au-
236 dacity, in his patent of March, 1887, to claim that he is the first to have obtained a governor capable of isochronism. He produced such isochronism by rendering an equilibrious governor stable, and he did this by exactly the same means and exactly the same combination which Ide had shown and claimed in the patent in suit, though Ball, to obtain his patent, resorted to the subterfuge of the alleged spring and manifestly hoodwinked the office into the belief that this spring and not the dash pot was the means for obtaining such stability.

These old doctored-up governors adduced by defendant, in my judgment, no more anticipate or contain or suggest the Ide invention than a spavined cart-horse, doctored up so as to hobble about, would be or suggest the possibilities of a carefully bred Kentucky racer.

X Q. 9. If a spavined cart-horse had been made better by being doctored by a remedy, would it be invention to apply the same remedy to a Kentucky race-horse for the same complaint?

A. The Kentucky race-horse of my answer is the complete and perfect conception and development, without spavin or other defects.

X Q. 10. Why do you assume that the Buckeye governor is not an isochronous governer? Is it because their catalogue said that they can only be adjusted so as to run within one per cent. under certain other circumstances and more than that under certain circumstances, and is that what you mean when you refer to a previous answer to cross-question, to their confessions in their calalogue?

A. The statements of the Buckeye catalogue, referred to in the question as given in the catalogue and not as garbled in the question, admit conclusively, what is otherwise evident from
237 the governor itself, that the governor is not equilibrious or isochronous. By that statement of the catalogue, it is only when the load of the engine is not subject to change and when the machinery driven is heavy that these exceptionally good regulations for them is obtained, and even this is alleged by them to be accomplished only by their present form of governor, having improvements which they point out as having been absent in their former governor and by which they even now claim they are able to only approximate isochronism and to do this only "under favorable load conditions. (See page 27 of Buckeye Engine Catalogue, second paragraph.)

X Q. 11. I wish to call your attention to "Defendants' Exhibit Complainant's Catalogue B, July, 1885," page 29, under the head "Perfect regulation." Does it not there say that the variation of speed from no load to full power of the engine will be less than one per cent.? And I wish, further, to refer you to the catalogue of Mr. Ide's licensees, the Harrisburg Car Manufacturing Company, marked Catalogue C, 1885, and which is in the bound volume of catalogues referred to in Mr. Ide's testimony. I call your attention to page 31, and ask you if it does not there read, under the head "Perfect regulation," as follows: "The variation of speed from no load to full power of the engine will be less than two per cent."

A. The language is properly quoted from these two catalogues. These are statements of very much higher perfection of regulation, however, than that of the Buckeye catalogue setting forth their last improvements in governors, wherein, under the head of good regulation, page 36, the catalogue says: "If the machinery driven contains in itself considerable momentum to assist that of the fly-
238 wheel, and is not subject to extreme changes of resistance, the conditions are favorable to close regulation, and in such

cases the variation of speed can, if desirable, be confined within one per cent." These conditions are very different from those specified in the Ide and Harrisburg Company's catalogues quoted in the question, wherein no reference is had to the weights of the machinery driven, and wherein the widest possible change in load is supposed—that is, the less than one or two per cent. will be secured even when the change is from no load at all to the full power of the engine, or the greatest load which the engine is capable of driving. Under the qualified statement of the Buckeye catalogue there might be a variation of from 5 or 10 per cent., or even more, for all this statement says to the contrary, under those extreme changes of load specified by Ide and his licensees. The Buckeye catalogue goes on immediately to say, "but when the load is destitute of momentum or *vis viva*, and is subject to great and sudden changes, it may be necessary to adjust for greater variation, according to the nature of the load." This statement is a conclusive admission that the Buckeye governor, even in its highest improved form, does not have and is not claimed to have equilibrity or isochronous action.

(All the answer after the first clause objected to as not responsive.)

X Q. 12. I want you to refer me to some build of engine which is governed solely by the fly-wheel, as stated by you in one of your direct answers.

A. Old-fashioned throttle-valved engines were very often without any governor on the throttle valve and were regulated as to their speed solely by their fly-wheel. Such engines were used in saw-mills and similar mills. I have seen them so run myself.

239 X Q. 13. But they never were run, were they, without the engineer regulating the supply of steam manually?

A. He would turn on the steam and let it run. Sometimes, when the current work was lightened or the steam pressure increased or the opposite of these occurred, he would go to the valve and close or open it, to give the desired speed to the machinery.

MELVILLE E. DAYTON.

Subscribed and sworn to before me this third day of August, A. D. 1888.

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

And thereupon complainant's counsel calls as a witness in its behalf Mr. FREDERICK W. HORNE, who, being by me first duly sworn to testify the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by Mr. C. K. OFFIELD:

Q. 1. Please state your name, age, residence, and occupation.

A. Frederick W. Horne; 31 years; Western manager Excelsior Electric Company; residence, Chicago, Illinois.

Q. 2. For how long a time have you been familiar, both practically and theoretically, with the different principal systems of electric

lighting in this country, and what attention, care, and study have you given to that subject personally?

A. About seven years, having during that time been familiar with all the principal systems in use in this country, and having charge of various plants, and have made it a continual study and kept posted from all electrical journals from week to week.

240 Q. 3. Please state what are the necessary elements which must of necessity at this day be present in a practical and successful electric-lighting system, and you may premise your answer to this question by a brief description of such plant or system for the possible instruction of the court.

A. A good dynamo, a good belt, a good lamp, pure carbons, and a well-regulated power to drive the dynamo.

Q. 4. What is the absolute necessity, if any, of this well-regulated power for the action of the dynamo and lamps? Give your reasons fully.

A. Dynamos driven at a certain speed give a certain current. If the speed on the dynamo is varied the current will vary accordingly, and therefore cause fluctuations of the light, which is detrimental to any system of lighting.

Q. 5. How serious a problem has this steady, uniform application of power to the operation of the dynamo been in this electric-lighting system?

A. Objections have been raised regarding the unsteadiness of light since electric light first came in general use, and it has been the desire of all parties interested in electric light to overcome it in some form of automatic regulation.

Q. 6. Are you familiar with the engines manufactured and sold by Mr. Albert L. Ide & Son, of Springfield, Illinois—I mean the engine manufactured by Mr. A. L. Ide, personally present here?

A. Yes.

Q. 7. How long and how extensively and thoroughly have you been familiar with such engine in its adaptation to and for electric-lighting purposes?

A. We commenced using his engine when first brought
241 out, about four or five years ago, and have purchased his make of engine from time to time since then, and have used more of his make of engine than any other style in connection with our plants.

Q. 8. In comparison with other engines known or used by you for driving dynamos and furnishing power for electric-lighting systems, as to uniformity, closeness, and perfection of regulation, how does the engine of Mr. Ide compare with that of all other manufacturers known to you?

A. I believe it to be the best of any we have had experience with.

Q. 9. To what do you attribute the closeness of regulation and regular speed in the Ide engine, as you have designated?

A. To his fly-wheel governor, which gives us the regulation, composed of the fly-wheel governor and dash pot, all combined to produce this steadiness of motion.

Q. 10. Please look at the model now shown you, representing the combination of fly-wheel, governor, and dash pot, and state whether or not this model correctly represents the fly-wheel governor and dash pot used and employed as a part construction of the Ide engine identified by you and to which you attribute the closeness of regulation and steadiness of movement of the Ide engine.

A. I should say the model is the same as that which is employed on various Ide engines which we have employed and which I have described.

(Complainant's counsel here offers in evidence the model identified by the witness and requests that the same may be marked "Complainant's Exhibit Complainant's Model.")

242 (Counsel for defendants objects to this exhibit as evidence, it not being made in accordance with the patent and drawings, and is therefore irrelevant as testimony, and also as it is improper as testimony at this time in the proceedings.

Cross-examination by Mr. J. K. Hallock waived, but he enters objection to the deposition as a whole on the ground that it is not proper rebutting evidence, being in contradiction of no evidence presented by the defendants.)

F. W. HORNE.

Subscribed and sworn to this 23rd day of July, A. D. 1888, before me—

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

And thereupon complainant's counsel calls as a witness in its behalf Mr. CHARLES E. JONES, who, being by me first duly sworn to state the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by Mr. C. K. OFFIELD:

Q. 1. Please state your name, age, residence, and occupation.

A. Charles E. Jones; residence, St. Louis, Missouri; occupation, engineer; age, forty-seven years.

Q. 2. Please state briefly what experience you have had which qualifies you for a correct understanding of the construction and operation of steam-engines.

A. I served a regular apprenticeship as a machinist, working several years subsequent thereto with various manufacturers
243 building steam-engines, both stationary and marine, subsequent to which I went into the marine service on western rivers in order to gain experience in the care and management of steam-engines, since which I have followed the profession of engineering in both the marine and stationary service and am now, at present, engineer in charge at Washington University, in St. Louis, Missouri, and an instructor in the manual training school department of said university, having been employed by them in these capacities for the past nine years.

Q. 3. What particular experience, if any, have you had which

qualifies you to readily understand the electric-lighting systems of this country and the necessities which exist for the perfection and operation of such systems?

A. My training as a machinist has qualified me to examine and understand the various engines and machinery used in this service and determine as to its fitness therefor in all their details, including the workmanship thereon, and the adaptability of the designs as to its workmanship, durability, ease, and care of management, and during the past twenty years have been frequently called upon to examine and test the various engines offered for this service, both as regards their economy and regulation. The regulation of electric-light engines being a most important and desirable feature thereof, I have given close attention to this particular point, and during my experience in the past twenty years in this capacity I have tested and examined upwards of more than one hundred different engines and now have on record tests and trials of more than fifty of such engines, some of my earliest records having been lost, my experience with electric-lighting engines in particular beginning with the introduction of such engines for this service.

244 Q. 4. What are the essential characteristics or component parts in an electric-lighting system as now used to make the same practical and successful?

A. The important points in the machinery driving an electric-light system are, first, a well-built and economical steam-engine that shall be durable, admit of being easily cared for in order that it may give continuous service extending over many hours, and that it shall give close, invariable, uniform current to the lamps. In order to do this, the engine itself, being the prime mover, must give most exact and uniform regulation under all varying conditions of loads and different steam pressures.

Q. 5. Are you familiar with the engines built by the complainant in this case and known as the Ide engines, and when did you first become acquainted with such engines and under what circumstances?

A. I am familiar with the Ide engines as well as others of the different types of engines offered for electric-lighting service. I first became familiar with the Ide engine in this service in October, 1884, having been called upon by the directors of the St. Louis exposition, through their chief engineer, General Shaler Smith, and his assistant, Mr. Hunter, to test the various engines employed at the exposition at this date to determine as closely as possible the economy and regulation of the several engines thus employed. This test extended over several weeks, every engine there employed being taken separately on separate days and run for several hours under full load and half load. Each engine was also especially tested in order to show its regulation by suddenly throwing on and off a number of times both half and full load. The full load consisted of 800 Edison lights; half load, 400; each engine serving
245 these lights over the same general circuit, these lights being used for lighting the Exposition building in all its parts, then completed, this building being about 300 feet square. The different

engines there employed were as follows: The Armington & Sims, the Albert L. Ide, the Cummer, the Westinghouse, the Ball engine of the defendants, and the Watertown, these being the leading engines manufactured at that time and offered for electric-lighting service, this test thus conducted being the most extreme cases to which an engine can be subjected as to closeness of regulation.

Q. 6. By what means or instrumentality did you make these tests and over what period of time did these tests extend?

B. Each engine tested at this time was subjected to a continuous run of four hours under each load, with the exception of the Ball engine, which was run two hours under each condition. The engines were indicated under each load, indicator diagrams being taken every ten to fifteen minutes, in order to show the general steam distribution, the revolutions of the engines being also, and at the same time that the indicator cards were taken, carefully counted and the revolutions at the time noted upon each card. Careful observations were also taken of the steam pressure and water levels of the boilers furnishing the steam to said engines. Careful comparisons were also made of the steam gauges attached to said boilers with the springs of the indicator used at the time in order to certify to their close correspondence. In addition to the careful observations of the steam pressure, the reelings of a recording steam
246 gauge were also noted. The conditions as to load and steam pressure were uniform in all the engines in proportion to their power.

Q. 7. Have you the memorandum and entries made by you at that time regarding these tests given as to all these engines; and, if you have, please refer to such entries and state the result of such tests respectively between such engines, identifying each engine in connection with each test.

A. I have before me the record of these tests, showing the number of lights driven, indicating horse power of the engine, piston speed in feet per minute, revolutions per minute, fluctuations, if any, under a given load, fluctuation from full to half load, percentage of fluctuation, and general dimensions of the engine, including the time under the different loads of each engine.

The first engine is the Westinghouse, cylinder 14 x 14, revolutions 275 with 800 lights.

Revolutions 278 with 400 lights.

Fluctuation with 800 lights, 0.

Fluctuation with 400 lights, 0.

Change of speed from full to half load, 3 revolutions, equal 1.09 per cent.

The next engine was the Cummer, cylinder 14 x 24.

Revolutions 142.8 with 800 lights.

Revolutions 142.8 with 400 lights.

Fluctuation with 800 lights, 4 revolutions.

Fluctuation with 400 lights, 4 revolutions, 2.8 per cent.

The next engine was the Ball, cylinder 10 x 12; revolutions 275 with 400 lights.

Revolutions 282 with 200 lights.

Fluctuation with 400 lights, 0.
Fluctuation with 200 lights, 0.
Change of speed from 400 to 200 lights, seven revolutions, 2.5 per cent.

247 The next engine is the Ide, cylinder 14 x 20.
Revolutions 205 with 800 lights.
Revolutions 205 with 400 lights.
Fluctuation with 800 lights, 0.
Fluctuation with 400 lights, 0.
Change of speed from 800 to 400 lights, 0.
The next engine was the Armington & Sims, cylinder 14½ x 13.
Revolutions 241.7 with 800 lights.
Revolutions 253 with 400 lights.
Fluctuation — 800 lights, three revolutions, equal 1.24 per cent.
Fluctuation with 400 lights, 0.
Change of speed from full to half load, 11.3 revolutions.
Percentage of fluctuation, 4.67 per cent.

The Armington & Sims afterwards improved this regulation by improving their governor, but there was still a variation of 3 revolutions from full to half load.

The Watertown engine was withdrawn from the competition as unsatisfactory.

A variation in electric-lighting engines giving a variation of from 2 to 3 revolutions would be considered unsatisfactory and is called "racing."

The above record will show that the Ide engine was the only one engaged in this test that gave absolutely perfect regulation under all conditions of varying loads. This was conclusively determined in this case of the Ide engine by the attachment of a tachometer, the indicator of which did show that there was no variation, this instrument being the most delicate and sensitive known for this purpose.

248 Q. 8. To what did you attribute this perfection and regulation of the speed and uniformity in the Ide engine at that test?

A. To the combination of the fly-wheel, governor, and dash pot in one piece of mechanism.

Q. 9. Please look at the model now shown you and marked "Complainant's Exhibit Fly-wheel Governor" and state whether or not such exhibit represents correctly and exactly the combined mechanism of fly-wheel, governor, and dash pot, used on that Ide engine in that test.

A. It does, to the best of my recollection.

Q. 10. Did any other engine there used have for its power wheel a combination of fly-wheel, governor, and dash pot?

A. It did not. There were no dash pots in any other governor there.

Q. 11. In the large number of engines, some fifty or more, that you have been familiar with for the last twenty years, has any engine given the result of uniformity and steadiness of speed of this

Ide engine, and to what did you attribute such uniformity and speed?

A. No; and I attribute the uniformity and perfection of the Ide engine to the combination of governor, fly-wheel, and dash pot.

Cross-examination by J. K. HALLOCK, Esq.:

X Q. 1. Several of the engines named in your test had fly-wheel governors without dash pots, did they not?

A. I think that the Armington & Sims was the only one.

X Q. 2. The Ball engine had a governor in the pulley wheel, did it not?

249 A. The Ball engine had a governor in a small light pulley, with fly-wheel separate from it on the other end of the shaft.

X Q. 3. Was it like the cut, figure 16, page 40, of the catalogue, "Exhibit E"?

A. To the best of my recollection, it was.

X Q. 4. The governor of that Ball engine was peculiar, in that it weighed the load in the manner of a dynamometer, and was therefore entirely different in principle from the governor shown in "Complainant's Exhibit Model of Defendants' Fly-wheel Governor," was it not?

A. It had this feature in common with the rest of the governors there exhibited, that it used the weights and levers commonly used in governors of this class, its mode of application being different. As I understand it, a dynamometer is a machine for weighing or indicating and recording the power exerted. The device in question had no indicating or registering mechanism. In this sense I shomld not call it a dynamometer pulley.

X Q. 5. You have tried to say too much, and, in saying it, have omitted to answer the question. I have said nothing about an indicator. I said which weighs the load in a manner of a dynamometer; but I will put the question in another form. Is it not a fact that the Ball governor used in those tests was a governor which is called by steam-engineers a dynamometrical governor, combined with a centrifugal governor, and was not like "Complainant's Exhibit Model of Defendants' Governor," which is a centrifugal governor only?

A. It differed from "Complainant's Exhibit Complainant's Fly-wheel Governor" only in the manner I have indicated in my answer to a former question, and I have never heard it called by the name mentioned.

250 X Q. 6. I still insist that you have evaded an answer to my question. I will put it in another form. Is it not a fact that the governor on the Ball engine used in those tests had the driving pulley loose upon the shaft and connected to the shaft by being connected to the arms of the centrifugal weights so that the weights could be moved by the direct action of the load, regardless of any change in speed?

A. The change of load would have a tendency to move the weights.

X Q. 7. This is not the case with the Ball governors which is shown in "Complainant's Exhibit Model of Defendants' Governor," is it?

A. It certainly is the case. The change of load effects the speed and weights in each governor.

X Q. 8. What I asked you is this: Does the Ball governor, the model of which you have in your lap, have a loose pulley on the shaft, which is connected with the shaft by being connected with the arms of the centrifugal weights?

A. It has no loose pulley on the shaft connected as you described.

X Q. 9. Then why didn't you answer "no" to my next previous question?

A. I tried to answer the question fully.

X Q. 10. You have said that this model of the Ide governor is an exact model of the governor which was on the Ide engine at the St. Louis exposition. Then I suppose that that engine governor had the same means for regulating the tension of the springs that are shown in this model, which are the subject of letters patent No. 308,498, issued to A. L. Ide, named in the bill of complaint
251 in this case as one of the patents alleged to have been infringed, but which allegation has not been insisted upon in the taking of proofs?

A. I think so.

(Counsel for defendant objects to this deposition as a whole as not being proper rebutting testimony, it not contradicting any evidence given by defendants, and for the further reason that it appears from the deposition itself that the Ball engine used at those tests was not constructed, so far as the governor was concerned, the same as the governor complained of in the bill of complaint and named in the complainant's *prima facie* case.)

R. D. Q. 1. Have you any interest in this case, or at the time of the St. Louis test had you any acquaintance with Mr. Ide?

A. No.

CHARLES E. JONES.

Subscribed and sworn to this 23rd day of July, A. D. 1888, before me—

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

Recess.

252 And thereupon complainant's counsel calls Mr. WALTER B. PEARSON as a witness in its behalf, who, being by me first duly sworn to state the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to the interrogatories propounded to him by Mr. C. K. OFFIELD:

Q. 1. Please state your name, age, residence, and occupation.

A. Walter B. Pearson; lawful age; Chicago; machinist and at present agent for A. L. Ide & Son in the sale of their engines at Chicago, Ill.; am a practical machinist and a mechanical engineer.

Q. 2. What experience have you had which qualifies you to understand the construction and operation of steam-engines, especially as used as the power motive in the different electric-lighting systems of this country?

A. I am a member of the American Society of Mechanical Engineers. At the age of fifteen I entered the mechanical engineering department of the University of Wisconsin and took a three years' course with this institution. For one year following I was regularly employed as an assistant in the machine shops at this college. Thereafter I worked in various machine shops, staying but a short time at each place, with a view to gaining as much knowledge as possible of the machinist's trade in general. For one year I had charge of the tool department of Warner & Swazey, of Cleveland, Ohio, and while there had charge of tool-work, general machine-work, and the building of astronomical instruments. In 1883 I went with the Cummer Engine Company of Cleveland, Ohio, for the purpose of designing special tools and machinery for cheap-
253 ening and improving the manufacture of their engines. In order to accomplish this work I was obliged to thoroughly acquaint myself not only with their engine, but with engines of other makes which were then prominent in the market. I spent considerable time in the study of the principles of steam-engines in general and of automatic cut-off engines in particular, paying especial attention to the details of governors and valve motions. During this period my time was devoted exclusively to the study of this subject and I was thoroughly examined and pronounced competent before I was allowed to go on with the work for which I was engaged. I afterwards went on the road for this same company and was engaged, first, in erecting and later in selling the engines manufactured by the Cummer Engine Company. I afterwards returned to Cleveland and took the position of assistant superintendant for the Cummer Engine Company, having entire charge of the manufacture of the engines. I filled this position for something over a year. I then took a position as the Chicago agent for A. L. Ide & Son, manufacturers of the Ide engine, which position I have held since that time. Since being with A. L. Ide & Son I have sold something over thirty engines for electric-lighting service. I make an almost exclusive specialty of electric-light work, and frequently contract for the entire steam plant to furnish power for electric-lighting stations. I frequently am called on to make plans for electric-light stations, and many stations are now in operation which have been built according to my plans. In the course of my business it has been necessary for me to keep thoroughly posted in regard to the engines with which I am brought in competition, and I have lost no opportunity with informing myself as to their general efficiency and the details of their construction. It has also been nec-
254 essary for me to post myself in regard to the various systems of electric lighting. Since the incandescent system for electric lighting has come into general use there has been an imperative demand for engines the regulation of which shall be practically perfect.

Q. 3. Will you please describe somewhat particularly in what an electric-light plant consists and the details of its operation?

A. The first thing to be considered in describing an electric-light plant is the motive power. In a few cases this power is furnished by water and need not be considered. In the majority of cases, however, the power is furnished by steam plant, consisting of a boiler, pump, heater, and a steam-engine; the latter is almost invariably of the automatic cut-off type. The electric plant consists of one or more dynamos, which are generally connected by belts to the fly-wheel pulley of the engine of various instruments located in the dynamo-room, consisting of the *b*olt-meter for measuring the strength of the current, the ammeter for measuring the quantity of the current, and, in the case of an incandescent-lighting plant, of resistance coils for regulating the amount of current which flows into any particular circuit. The line or circuit is of insulated copper wire and may be of any length, the length of the circuit and the number of lamps to be run regulating the size of the wire, the size of the wire increasing as either of these factors increases. There are two systems of electric lights, known as the arc system and the incandescent system. Each of these systems is subdivided into systems of various names invented by different persons. They differ, however, from each other only in detail, the fundamental principles being
255 the same in all. The arc lamp consists of a frame with clock-work. This clock-work is used for moving a rod, known as the carbon rod, lengthwise. To the lower end of this rod is attached what is known as the positive carbon. Before the current is passed through the lamp this carbon rests on the negative carbon, which is directly beneath it, and is attached immovably to the frame of the lamp. These carbons are cylindrical in shape and will average about one-half inch in diameter by about twelve inches long. When the electric current is passed through any number of these lamps, which are placed in series on the circuit, it first passes directly through the carbons without producing light. It immediately, however, so operates on the clock-work of the lamps as to cause the carbons to separate, producing what is known as the arc light. The average strength of the current on arc-light systems is from 500 to 2,000 volts, according to the number of lamps in circuit, each lamp requiring from 30 to 50 volts, according to the system. The quantity of the current varies from 9 to 20 amp*hie*r-s, according to the system. In the arc-light system the positive or upper carbon is consumed at a rate of about one inch per hour and the lower carbon about half an inch. The clock-work in the lamp feeds the carbons together as they are consumed, so that the proper distance is maintained between them. In case the current should be interrupted from any cause or the arc should be broken, the clock-work allows the carbons to come together until the circuit is made, when they again separate and establish the arc. The incandescent lamp consists of a glass bulb from which the air has been expelled. Inside this bulb is a carbon filament. This loop is of different
256 forms, as the lamp is made by different companies. The composition of the filament also is different with lamps from

different makers. Each end of the filament connects with a small platinum wire, which passes through the glass at the small end of the bulb. These wires are connected by various keys and sockets (varying according to the purpose for which they are to be used) with the copper wire of the circuit. When the current is passed through these lamps, the carbon filament, owing to the great resistance which it offers to the passage of the current, becomes heated to incandescence, the intensity of which depends upon the intensity of the electric current. This latter varies in different systems from 50 to 110 volts. The quantity of the current depends upon the number of lamps in the circuit, each lamp requiring from .50 to .75 of an amphier-. In order to maintain the light of a uniform brilliancy it is absolutely necessary that the current passing through it shall be uniform. In order to secure this uniformity of current the dynamo must maintain a uniform speed. To secure this result the regulation of the engine which drives the dynamo must be practically perfect. Any failure in the engine in this respect produces a flickering in the light, proportionate to the irregularity of the engine. This, of course, is not admissable and no electric-light plant would be accepted by purchasers and no central station could rent lights to subscribers where this flickering occurred, as such a light is admitted to be injurious to the eyes and deceptive in its effects. In the operation of an electric-light plant the principal factor of financial success is reducing the running expenses to a minimum. One of the greatest items of the expense in the operation of an electric-light plant is the replacing of incandescent lamps in which carbon
257 filament has been broken or burnt out. The usual guarantee of life for these lamps is an average of 600 running hours for each lamp. It is a well known and established fact that the life of the lamp depends on the steadiness of the electric current. I am creditably informed from records taken from electric plants operated by engines sold by me for A. L. Ide & Son that in several instances the life of the lamps has averaged over 1,800 hours per lamp. I also know of instances w-ere incandescent electric-light plants are run by engines of an inferior make where the life of lamps falls below 600 hours.

Q. 4. Please designate some of the most important buildings or plants in Chicago which are operated by the Ide engine.

A. The Cook county buildings, consisting of the court-house (one engine, running 1,000 incandescent lamps); the hospital (one engine, running 800 incandescent lamps); the county jail (one engine, running 500 lights); Cook county insane asylum (one engine, running 500 lights); county infirmary (one engine, running 300 lights); the Haymarket theatre (two engines, running 1,200 lights); the Eden Musee (one engine, five hundred lights); Chicago city railway cable station (both arc and incandescent lights, number not known); Union Stock Yard & Transit Company (one engine, 60 arc lights); Chicago & Northwestern passenger railway depot (one engine, 600 incandescent lights); Hibbard, Spencer, Bartlett & Company's store (one engine, 600 incandescent lights); the Consumers' Electric Light Company (one engine, 120 arc lights);

Morris & Goldschmidd (one engine, 30 arc lights); Atwood clothing-house (one engine, about 50 arc lights); Golden Eagle
258 clothing-house (one engine, about 25 arc lights); Davis & Morse Company (two engines, about 50 arc lights). We also furnished the two engines in Auditorium building, which run about 2,200 incandescent lights during the recent Republican convention, and a large number of other engines.

Q. 5. Please state what steadiness and uniformity of movement there is in the engines and electric current produced thereby in the different plants you have identified, and what satisfaction such plants give to the users and patrons who depend upon and are familiar with the same.

A. The plants are all giving satisfaction in every way, so far as steadiness of movement in the engine and uniform brilliancy of the lights are concerned. The regulation of the engine in each case is so perfect that no variation is detected in the speed by ordinary methods. In several instances where a tachometer (the most sensitive instrument known for this purpose) has been attached to an engine it has shown a variation of less than one per cent. at any instance.

Q. 6. To what severity of tests as to regularity and uniformity of movement of lights are these Ide engines subjected?

A. The tests which I have personally conducted have been made when the engines were doing their regular duty, and during the course of my tests as much as fifty per cent. of the load was frequently thrown off instantaneously, and I have on several occasions for experimental purposes thrown the entire load both on and off the engine with a resultant change in speed of less than one per cent. In average practice electric-lighting engines are subject to constantly changing loads, and any failure of the engine to respond to a change in the load, due to a number of lamps
259 being thrown off, will result in greatly increased brilliancy of the lights remaining in the circuit and the possible breakage of the lamps.

Q. 7. Please look at "Complainant's Exhibit Complainant's Fly-wheel Governor" and state what it is and what it represents.

A. It is a correct working model of the fly-wheel governor and dash pot used on the Ide engines which I have described.

Q. 8. To what do you attribute and recognize in the Ide engine the regularity and uniform movement of the engine and uniform electric current present in the engines and electric plants which you have specified and referred to in your previous answer?

A. To the combination of the fly-wheel, governor, and dash pot, which overcomes the defects in governors and fly-wheels which produce these irregularities in other engines. I am confirmed in this belief by the fact that I have at various times been called upon to examine engines of other makes which were doing service on electric-light plants, but which, owing to their poor regulation, were not giving satisfaction. I have almost invariably succeeded in locating the trouble somewhere in a governing mechanism. To the best of my knowledge and belief, all of the defects which I have found in

governors of other makes are overcome in the Ide governor consisting of the combination I have recited.

Q. 9. You have stated that the life of the incandescent lamp depends greatly upon the uniformity of the electric current to which it is subjected. Can you state from your personal knowledge any instance by way of illustration which makes certain and con-
260 firms this fact by a substitution of the Ide engine with the governor formed of the fly-wheel, governor, and dash pot and an engine running the same lights without the dash-pot element in such fly-wheel and governor combination?

A. The Chicago & Northwestern Railway Company put in a large incandescent plant to light their shops at West Chicago; to run this plant, they put in an automatic engine with a disk governor. This plant was in operation throughout the winter and the lamp breakage was excessive, the life of the lamps falling far below that which was expected of them. Since the installation of this plant I have sold three Ide engines to the Chicago & Northwestern Railway Company. Two of these engines are running electric-light apparatus of the same kind as that installed in the West 40th street shops. These engines are giving perfect satisfaction and the lamp life is far in excess of that guaranteed by the makers of the lamps. That this is due to the engine is proven by the fact that the authorities of the Chicago & Northwestern Railway Company have decided to throw out the engine running the lights at the West 40th street shops and have given us an order for and we are at present building an engine to replace it.

Q. 10. Is there any other engine manufactured and sold in the trade for electric-lighting purposes that has this uniformity of movement and steadiness of electric current and lighting, as you have described, except the Ide engine having the combined fly-wheel, governor, and dash pot?

A. None, except the Ball engine, which has the same combination and arrangement.

Cross-examination by J. K. HALLOCK, Esq.:

X Q. 1. You did not state your age; please state it.

A. Twenty-seven years.

261 X Q. 2. You did not state the date when you commenced selling the Ide engine. Please state that.

A. July 1, 1887.

X Q. 3. Did you ever see an Ide engine in operation which had a governor exactly like "Complainant's Exhibit Model of Complainant's Governor," with the exception of the dash pot—that is to say, without any dash pot?

A. I have not.

X Q. 4. You have spoken of several instances where electric-light lamps have been operated by engines which were not properly governed and were unsatisfactory, and were thrown out and other engines put in. Will you please give the names of those engines that were thrown out?

A. I did not mention several cases. In fact, I did not mention any cases in which the engines had been thrown out. The only case which I did mention was that of the Chicago & Northwestern Railway Company, for whom we are at present building an engine to replace the Atlas engine, which ran their electric plant in the West Chicago shops during the past winter. The engine is not in operation at the present time.

X Q. 5. Who is the builder of the Atlas engine?

A. Atlas Engine Company of Indianapolis.

X Q. 6. What kind of a governor was there on that engine? Whose invention was it?

A. The governor was a shaft governor and is said to have been designed by a person named Ladd.

X Q. 7. Was the governor built by the Atlas Company or was it built here in Chicago and put on that engine to be tried?

262 A. I am informed that the governor was built by Chicago parties, but that it was not put on this engine for trial; that several governors of this style had been built by the same parties previously, and applied to engines used on work which required less sensitive regulation than electric lighting.

X Q. 8. In your opinion, would the Ide governor, if adjusted at sufficiently less than full theoretic tension, be made to govern an engine within one or two per cent. of isochronism if it had no dash pot?

A. It could not.

X Q. 9. Why not?

A. For the reason that if the springs are adjusted at enough less than theoretic tension to prevent the engine from racing, the difference in the speed of the engine necessary to produce equilibrium, between the centrifugal force of the weights and the centripetal force of the opposing springs, will, in my opinion, exceed the percentage named.

X Q. 10. Are there not several manufacturers of steam-engines whereon are used shaft governors who claim to be able to get within one or two per cent. of isochronism who do not use a dash pot in the governor?

A. I do not know of any concern which builds automatic engines without a dash pot in the governor who will guarantee that the variation in the speed of the engines built by them shall not at any instance exceed one per cent.

X Q. 11. That isn't an answer to my question. I ask if they do not claim to be able to get within one or two per cent. of isochronism. Do they not claim it in their catalogues?

A. I have not seen any such claim published, to the best of my recollection.

263 X Q. 12. In your answer to direct question 10 you referred to the Ball engine. Do you mean the Ball engine having thereon a governor like "Complainant's Exhibit Model of Defendants' Fly-wheel Governor"?

A. I do.

Redirect examination by Mr. C. K. OFFIELD:

R. D. Q. 1. Have you ever made any test of any spring in connection with the dash pot contained in combination with the fly-wheel and governor of the Ball engine, like "Complainant's Exhibit Defendants' Fly-wheel Governor," to determine the strength and resiliency of the spring? And, if so, please state the details of such test and compare the spring so tested with the spring appearing in "Complainant's Exhibit Defendants' Full Size Dash Pot and Spring" as to proportion and tension.

(Counsel for defendant- objects to question as not redirect examination, and states that while this deposition appears on the record as if taken after Mr. Ide's deposition the direct examination was, in fact, taken before Ide's deposition, and therefore the subject-matter inquired of is manifestly improper at this stage.)

A. In July, 1887, I removed the spring in question from a Ball engine in the electric-light station at Lake View. I found that a weight of 188 pounds was necessary to elongate this spring one-eighth of an inch. The exhibit in question corresponds very nearly to the spring examined by me and taken from the engine at Lake View. I am unable to state definitely as to whether or not the elasticity of this spring is the same as that examined by me. The dimensions of this spring, however, being about the same as
264 that of the spring in the Lake View station, it is my opinion that its elasticity will be found practically the same. The only difference I can detect in this spring is that the Ball engine spring was about four and one-half inches and the exhibit is four and three-fourths.

R. D. Q. 2. Does that spring in the dash pot of the Ball engine have any practical or beneficial effect whatever in the operation of the engine?

(Objection renewed.)

A. I have made calculations based on the experiment related in my preceding answer which demonstrate clearly that it can have no effect whatever.

(Defendants' counsel objects to the whole deposition as reopening in its nature.)

W. B. PEARSON.

Subscribed and sworn to before me this sixth day of August, A. D. 1888.

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

And thereupon complainant calls FREDERICK SARGENT as a witness in his behalf, who, being first duly sworn, testifies as follows in answer to interrogatories propounded by C. K. OFFIELD, Esq.:

Q. 1. Please state your name, age, residence, and occupation.

A. Frederick Sargent; 5110 Lake avenue, Hyde Park; occupation, mechanical engineer; age, 29.

Q. 2. Are you now connected with any of the great electric-lighting systems in this country; and, if so, what company and in what capacity and for how long?

A. I am connected with the Chicago Edison Company as
265 general superintendent; have been in that capacity for one year.

Q. 3. What territory does that company own and occupy?

A. The Chicago Edison Company occupies the territory of Cook county, Illinois.

Q. 4. Was you connected with the Edison system before taking the superintendency of the Chicago Edison Company; and, if so, what capacity, what length of time, and what territory?

A. I was connected with the Western Edison Light Company for two years in the capacity of mechanical engineer. That company controlled the States of Illinois, Wisconsin, and Iowa.

Q. 5. What were and are your particular duties in connection with those two companies and do you understand entirely the construction and operation of an electric plant from the generating power to the perfection of light required?

A. My particular duties with the Western Edison Light Company were to plan and supervise all installations in the territory mentioned. In connection with the Chicago Edison Company I had the planning and inspecting of the large central station in connection with the general superintendence of the company's business. I understand thoroughly the requirements of a modern electric-light plant from the generating power to the perfection of light required in the incandescent system.

Q. 6. What light does the Edison Company put in its plants?

A. The incandescent light solely.

266 Q. 7. Please state upon what principal factor or element, if any, more than all others, the practical and successful working and operation of an incandescent-light system depends and give your reasons for any statement you may make.

A. The most prominent point in the successful operation of a first-class electric plant is that the motion imparted to the generators be as uniform as possible, because the flow of current varies as the motion of the generator varies and the candle power of the lamps vary as the flow of current varies, and as the steadiness of the candle power is the great object to be obtained in the successful use of the incandescent light I consider this point very vital. Annother point tending to show the importance of a steady flow of current through the lamps is the lamps are constructed to take a certain amount of current and guaranteed to live a certain life, provided this flow of current is not increased. Increased flow of current and variations in flow resulting almost in every case from variations in speed of the generator shorten the life of the lamp by destroying the carbon filament in the air-tight globe, and as the expense of lamps bears a large proportion to the total operating expenses of electric-light plants the lamp-breakage question is a very serious one.

Q. 8. Are you acquainted with the engines manufactured by the

complainant in this case, A. L. Ide, for electric-lighting purposes; and, if so, how long have you been acquainted with such engines?

A. I am well acquainted with the engines manufactured by A. L. Ide for electric-lighting purposes and have been so for a period of two years.

Q. 9. How extensively have the two Edison companies named by you adopted the Ide engine for running their electric
267 plants—I mean especially the Western Electric Company, covering the States of Illinois, Iowa, and Wisconsin?

A. Since using the first Ide engine and having the points of merit brought before our notice, and from the good results obtained, we have recommended them and used them ever since as being the best engine for our business.

Q. 10. To what construction existing in the Ide engine do you attribute the good results you have mentioned? And please state specifically the principal of such good results.

A. The principal point in the construction of the Ide engine which makes its use so valuable to us is the fine construction of its fly-wheel governor in combination with the dash pot, which we find gives more uniform speed and closer regulations under all conditions of varying load and steam pressure than any engine we have had experience with.

Q. 11. How close regulation does this Ide engine give. And, if you know this fact from actual test, please state briefly such test.

A. The Ide engines are sold to us under a guarantee of not over 2 per cent. variation, and we believe from experience and from actual test that the guarantees are fully substantiated in every case. I made a test of a 40-horse-power Ide engine sold to the Northwestern Railroad Company and found the variation to be only one per cent. in throwing off the full load of the engine suddenly. Another of our experts in the employ of the parent Edison Company made a test of an Ide engine used for operating a station owned by our company at Elgin, Illinois, and in his report to me said it was the
268 finest governing engine (giving the closest regulation) of any he had tested, and his experience has been considerable in the Edison business.

Q. 12. Your deposition has practically answered the question, but I will ask you specifically whether this Ide engine accomplishes and assures the good results you have denominated as vital to the successful operation of an incandescent electric-light plant.

A. I say it does.

Q. 13. Please look at the device now shown you (complainant's counsel here shows witness "Complainant's Exhibit Complainant's Fly-wheel Governor") and state what it is and what it represents.

A. This is a fly-wheel governor, with dash-pot combination, consisting of fly-wheel governor and dash pot in use on the Ide engines. It represents the same combination of governing devices as sold to us by A. L. Ide and in use on all his electric-light engines.

Q. 14. Please state whether or not the Edison companies have

used the engines of the principal manufacturers of this country in their incandescent electric-lighting systems other than Mr. Ide.

A. The Edison companys have used probably every type of engine of prominence manufactured in this country.

Cross-examination by J. K. HALLOCK, Esq.:

X Q. 1. What other type of engine are you familiar with which are used by the Edison Company?

A. I am familiar with nearly all of the type either from observation or actual experience.

X Q. 2. Are you familiar with the Armington & Sims engine and the Straight Line engine made by Prof. Sweet?

269 A. I have had personal experience with the two types mentioned.

X Q. 3. Both of the engines have fly-wheel governors, have they not, but no dash pot?

A. Yes; they have.

X Q. 4. The Armington & Sims engine has been a standard engine of the parent Edison Company of New York and has been recommended by them for a number of years, has it not?

A. Yes; they have.

X Q. 5. Is it not probable that there are more Armington & Sims engines used for running Edison electric-light plants in this country at the present day than any other make of engine?

A. I am sure such is the case.

X Q. 6. Is it not probable that there are more Edison electric-light plants in this country which are served by Armington & Sims engine than they are served by all other kinds of engines?

A. I do not feel sure that such is the case, but I know a large proportion of the engines used are Armington & Sims engines.

X Q. 7. Did you ever use an Ide engine or see one used which had a governor like that model which you have been referred to, which had no dash pot in it?

A. I have never seen one used without having the dash pot.

X Q. 8. Do you think or do you not that a governor like that model, which had no dash pot, could be adjusted so as to give as good regulation as those you have used which had no dash pot?

270 A. I have never experimented with the governor in this way, but I do not think it possible to get as good results without the use of the dash pot as with it.

X Q. 9. Do you give this opinion as a mechanical engineer?

A. Yes.

X Q. 10. Please state your reasons for your opinion.

A. I think if the governor was used without a dash pot the result would be a racy engine, because all governors I have experience with race more or less, except in the case of the Ide engine governor.

X Q. 11. Now, please tell us what you mean by the word "racing."

A. I mean that the action on the governor would be such as to cause it to continually fluctuate, and while the total number of revolutions in any one minute might be very nearly the same as that obtained in another minute, one revolution as compared to another revolution represent very different periods of time.

X Q. 12. When an engine is racing do not the weights of the governor have sudden radial movement from one orbit to another?

A. Yes; they do.

X Q. 13. And is it your opinion that the use of the dash pot in the Ide governor prevents this sudden radial action of the weights?

A. The radial action of the weights, I think, is caused by two factors—one is variation and speed of the engine and another is the stiff or unstable equilibrium of the governor. The action of the dash pots in the Ide engine is to control this unstable condition of the governor.

X Q. 14. Well, does the dash pot prevent the undue sudden radial movement?

271 A. It does not prevent the sudden radial movement due to tendency of change in velocity of the fly-wheel. Its use is more to prevent the fluttering, so to speak, of the governor in any given position.

X Q. 15. The Ide patent says that the object of the use of the dash pot is to prevent wide and sudden radial movement of the weights. Do you think that so?

A. I think that such is the case, in the sense that it prevents the weights from moving out too far than the position due to the velocity would warrant, but I am not acquainted in any way with the points in the Ide patent on this governor.

(Counsel for defendant- objects to the direct examination of this deposition as not proper rebutting evidence.)

Redirect examination by C. K. OFFIELD:

R. D. Q. 1. Do you know whether or not the parent Edison Company had a contract for the purchase of the Armington & Sims engine for a certain length of time or interested in such engine?

A. I have only heard reports from outsiders that the parent Edison Company are in some way interested in the Armington & Sims Engine Company, but I have no reason to believe myself that such is the case.

F. SARGENT.

Subscribed and sworn to this 6th day of August, A. D. 1888, before me—

FREDERICK C. GOODWIN,
Notary Public.

[SEAL.]

272 And thereupon counsel for complainant calls DE LORMAN T. BRONSON as a witness in his behalf, who, being duly sworn, testifies as follows in answer to interrogatories propounded to him by Mr. C. K. OFFIELD:

Q. 1. Please state you name, age, residence, and occupation.

A. De Lorman T. Bronson; age, 54; residence, Chicago; occupation, now engineer in charge of the engine of the building 116 and 118 Dearborn street.

Q. 2. How long have you been a practical engineer, running and operating engines personally, and what engines have you operated specially for the last ten years, particularly for electric-lighting purposes?

A. Armington & Sims, Westinghouse, Ide, Payne, Ball, Buckeye, the Straight Line—all these I have operated for electric-lighting purposes during the last four or five years and I have operated engines before that for twenty-five years.

Q. 3. Which of these engines you have run and operated as mentioned gave the best results as to closeness of regulation and steadiness of light under all conditions of load and steam pressure?

A. By indicating with the speed indicator I got the closest results and regulation with the Ide engine, that engine not varying quite two per cent. from no load to full load.

Q. 4. To what cause or construction of the Ide engine was this closeness of regulation due?

A. I considered always it was the governor in the fly-wheel and dash pot.

273 Q. 5. Did the Ball engine you used at that time or any of the other engines have a dash pot in combination with the governor and fly-wheel?

A. No.

Q. 6. Please look at the model now shown you, marked "Complainant's Exhibit Complainant's Fly-wheel Governor," and state whether or not such model correctly represents the combination of fly-wheel, governor, and dash pot on the Ide engines run by you and of which you have spoken.

A. I don't see any difference.

Cross-examination by J. K. HALLOCK:

X Q. 1. When did you last run a Ball engine?

A. I quit running them a year ago this month—two of them.

X Q. 2. When was that engine set up?

A. I don't know.

X Q. 3. Was the governor on that Ball engine like the model, "Complainant's Exhibit Defendants' Fly-wheel Governor"?

A. It had no dash pot, and it was on a loose pulley.

X Q. 4. Did the Armington & Sims engines and the Straight Line engines which you have run have the governor in the fly-wheel?

A. The Straight Line had the disk especially to carry the gov-

ernor. The Armington & Sims, the governor was in the fly-wheel. The Armington & Sims engine was taken out and the Ide engine put in its place.

(Counsel for defendant- objects to the last part of his answer as not responsive and as it was suggested by Mr. Ide, the complainant, who keeps talking to the witness.)

274 X Q. 5. Was the Ide engine put in place of the Armington & Sims engine of the same or greater power?

A. The Ide was ten-horse power more than the Armington & Sims.

(Counsel for defendant- also objects to the whole deposition as immaterial and not rebutting testimony.)

DE LORMAN T. BRONSON.

Subscribed and sworn to this 6th day of August, A. D. 1888, before me—

[SEAL.] FREDERICK C. GOODWIN,
Notary Public.

(Endorsed:) Filed Apr. 9, 1889. Wm. H. Bradley, clerk.

275 United States Circuit Court, Northern District of Illinois.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.* } In Chancery.

COMPLAINANT'S EXHIBIT COMPLAINANT'S PATENT. Frederick C. Goodwin, Notary Public.

277 UNITED STATES PATENT OFFICE.

ALBERT L. IDE, of Springfield, Illinois.

Steam-Engine Governor.

Specification forming part of Letters Patent No. 301,720, dated July 8, 1884; application filed July 11, 1883. (No model.)

To all whom it may concern:

Be it known that I, Albert L. Ide, of Springfield, in the county of Sangamon and State of Illinois, have invented certain new and useful improvements in steam-engine governors; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of steam-engine governors known as "fly-wheel governors," and has for its primary object to provide means for holding the eccentric steadily in its proper poised position, in opposition to the tendency of certain extraneous forces which are calculated to disturb the movements of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion.

To this end the invention consists in the combination of a dash-pot with the governor and pulley, said dash-pot connected with a fixed and a movable part, or with two relatively or unequally movable parts—as, for example, with the extremity of a weight-lever and the pulley-hub.

In this class of governors the position of the eccentric is variably determined by the opposing and self-balancing forces exerted by the centripetally-acting spring or springs and the centrifugally-acting weight or weights connected with said springs, the intention being to hold the eccentric permanently in a certain poised position for a given speed of the wheel to which the governor is applied, and to vary the position of the eccentric exactly as the speed of said wheel is varied. There are, however, certain temporarily-acting causes of disturbance calculated to change the position of the eccentric independently of the speed of the wheel. The principal of these disturbing causes is the inertia of the reciprocating parts, including the eccentric and the parts actuated thereby; and a

(No Model.) 2 Sheets—Sheet 1.

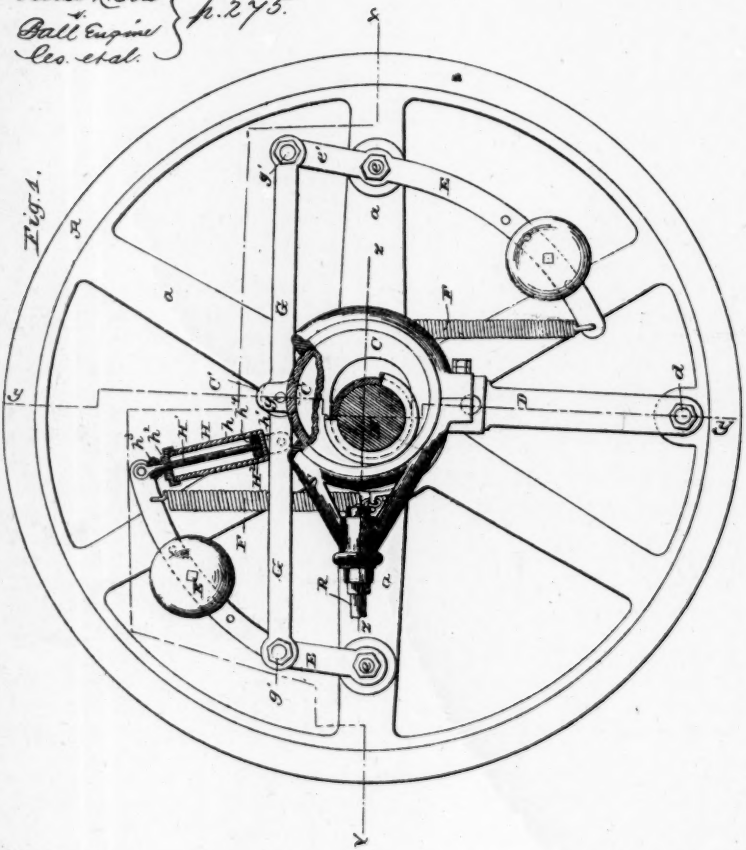
A. L. IDE.

STEAM ENGINE GOVERNOR.

No. 301,720. Patented July 8, 1884.

No. 227.
Albert L. Ide
Ball Engine
Leo. et al.
} p. 275.

Fig. 1.



Witnesses.
Jno. W. Starkett.
C. C. Poole

Inventor.
Albert L. Ide
per W. E. Dayton
Attorney

(No Model.) 2 Sheets—Sheet 2.

A. L. IDE.

STEAM ENGINE GOVERNOR.

No. 301,720. Patented July 8, 1884.

No. 227.
Albert L. Ide
v.
Ball Engine Co. et al.
p. 276.

Fig. 2.

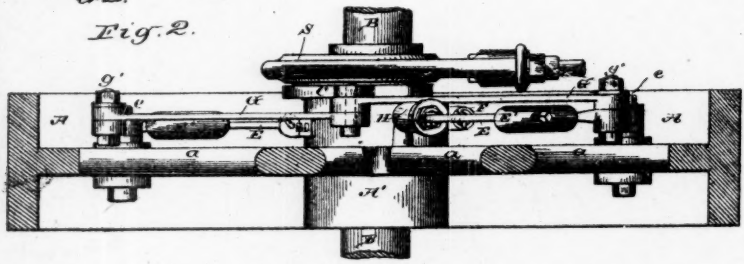


Fig. 3.

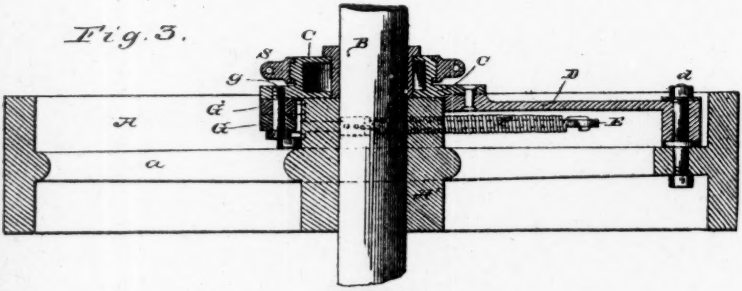
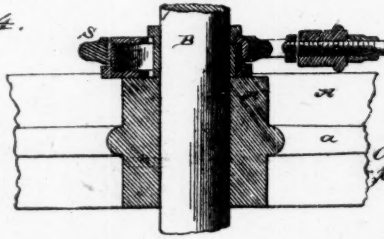


Fig. 4.



Witnesses:
Jno. W. Stockett.
C. C. Poole

Inventor
Albert L. Ide
per W. E. Dayton
Attorney

secondary cause is the gravity of the eccentric when not counterbalanced by some special device for the purpose. At a regular and very high speed of the governor wheel or pulley these disturbing forces operate but slightly, owing to the momentum of the weights, which serve to prevent their deflection from a regular course; but at lower speeds than that at which the apparatus is adjusted to run, and particularly in accelerating or retarding the engine, as in starting up or slowing down, these incidental disturbing forces interfere materially with the valve action and give an objectionable irregularity to the movements of the weights. In the case of an engine used for running a dynamo for electric-lighting purposes, and subject to sudden and wide changes in requisitions of power and speed, the effects of the disturbances referred to manifest themselves also in the quality or intensity of the lights. A dash-pot constructed and attached to the apparatus in such a manner as to prevent sudden movements of the weight-levers or of the eccentric is found in practice to wholly overcome the defects indicated and to give a desirable steadiness and regularity to the movements of the movable parts of the governor as well as accuracy and reliability to the cut-off action of the valve.

The improvement will be understood from the following description and accompanying drawings.

(Here follow diagrams marked pp. 275 and 276.)

In said drawings figure 1 is a side elevation of a pulley provided with a governor having my improvement, the dash-pot being shown in axial section. Fig. 2 is a section of the pulley in the indirect line *x x* of Fig. 1. Fig. 3 is a section of the pulley and other parts in the indirect line *y y* of Fig. 1. Fig. 4 is a fragmentary section of the pulley and other parts in the line *z z* of Fig. 1.

A is a pulley or wheel having arms *a a*, and secured by its central hub to the shaft B.

C is an eccentric having the slot or opening *c*, by which it movably embraces the shaft B; and D is an arm attached to the eccentric and supporting it from the body of the pulley by a pivot-pin at *d*.

S is the eccentric-strap, applied in any approved manner to the eccentric and joined with the valve-rod R.

E E are two upright levers, fulcrumed at *e e* to opposite points on the pulley A, and E′ E′ are the weights applied adjustably as to their position to said levers. The weight-levers project in opposite directions from their pivotal points, so that the weights
277½ E′ thereon, when properly located, stand at diametrically opposite points of the pulley and counterbalance each other. One of the levers E is extended beyond its fulcrum *e* by the short arm *e′*. To the extremity of this arm *e′*, and to the opposite lever E, at a point inward an equal distance from the fulcrum, are pivoted the outer ends of connecting-rods G G, whose inner ends are pivotally joined to the eccentric C, preferably by a common pin, *q*, to a lug, C′, located on the eccentric at a point opposite the support-

ing-arm D, said rods G being arranged substantially in line with each other and at right angles with said supporting-arm. Near the free extremities of the levers E E, and at points equally distant from their fulcra, coiled springs F F are connected therewith, and the opposite ends of said springs are attached to suitable points on the pulley. In this construction the equal weights E′ evidently counterbalance each other, leaving the eccentric without counterbalance and subject to the action of gravity whenever the slot *c* therein is vertical.

H is a dash-pot, the cylinder *h* of which is provided at its closed end with a lug, *h′*, by which it is pivotally connected either with the pulley, the eccentric, or one of the rods G. As here illustrated, it is connected with a rod, G. Said dash-pot cylinder has at its open end a close-fitting cap, h^2, through a central stuffing-box, h^3, on which passes the piston-rod H′. The outer end of this rod is pivotally connected with the end of one of the weight-levers E, and its inner end is provided with a piston, H^2, fitted to the interior of the cylinder *h*, and apertured at h^4. The cylinder of the dash-pot is filled with glycerine or some other non-compressible liquid, preferably one that is also not congealable at a temperature to which the engine is likely to be exposed. By means of the dash-pot applied to the relatively movable and stationary parts or to the unequally-moving parts as described, wide and sudden radial movements of the weights E′ are prevented, and as a consequence the governor will have a steady and efficient action at all speeds of the pulley or wheel to which said governor is applied. The aperture h^4 will be made of such size (according, of course, with the size of the cylinder, springs, and weights) as to allow all necessary promptness of action on the part of the governor, and said aperture may, if desired, be made adjustable to its size by ordinary and well-known means for the purpose.

The dash-pot, while preferably connected with the end of the lever E, may obviously be attached to the eccentric itself and to a fixed or less movable part of the apparatus.

By the term "dash pot" in the appended claim I mean the device technically known by that name—usually comprising a closed cylinder, a piston having a passage through or around it, and a fluid confined in the cylinder, as shown—or its equivalent.

I claim as my invention—

In a fly-wheel governor, the combination, with relatively-movable parts, of a dash pot, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

ALBERT L. IDE.

Witnesses:
J. F. BUNN.
CHAS. A. ORR.

278 Filed Ap'l 9, 1889.

WM. H. BRADLEY, *Clerk.*

(No Model.) 3 Sheets—Sheet 1.

A. L. IDE.

STEAM ENGINE GOVERNOR.

No. 308,498. Patented Nov. 25, 1884.

No. 227. Albert L. Ide vs. Ball Engine Co. et al. } p. 278

Fig. 1.

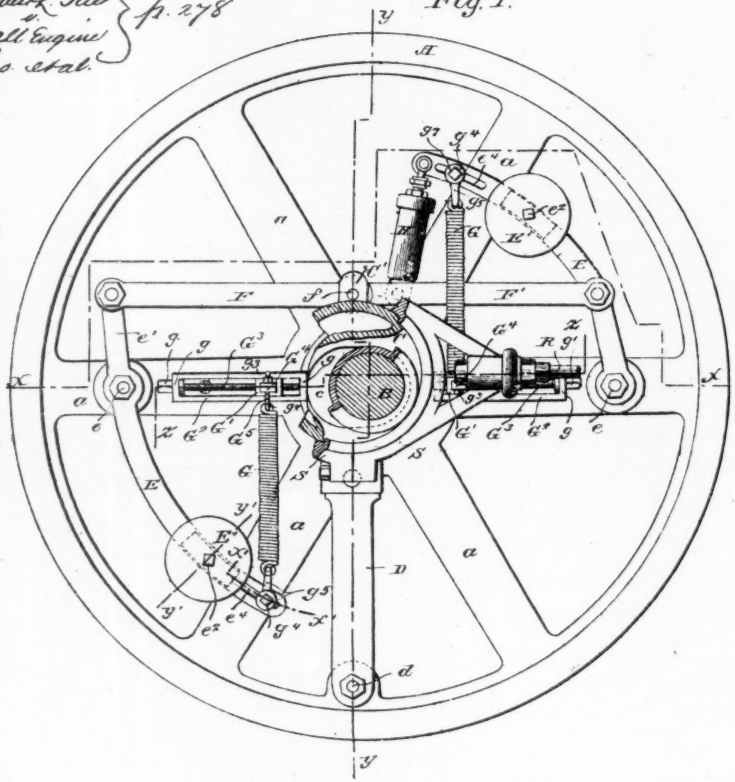
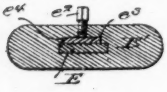


Fig. 7.



Witnesses:
Jno. H. Smith
C. C. Poole

Inventor
Albert L. Ide.
by Wm. E. Dayton
Attorney

(No Model.) 3 Sheets—Sheet 2.

A. L. IDE.

STEAM ENGINE GOVERNOR.

No. 308,498. Patented Nov. 25, 1884.

Fig. 2.

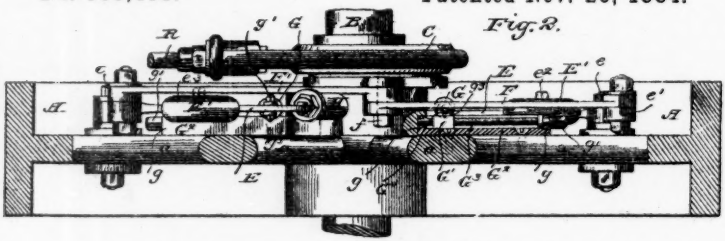
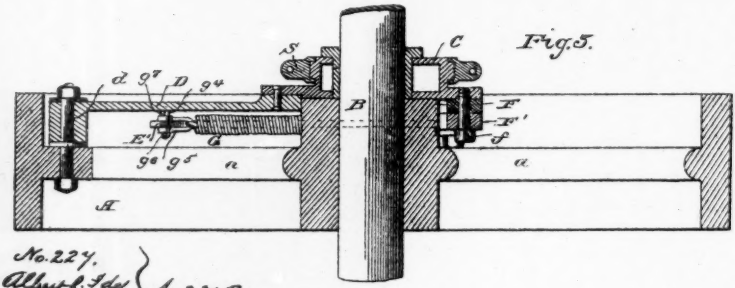


Fig. 3.



No. 224, Albert L. Ide et al. v. Ball Engine Co. et al. p. 279.

Fig. 4.

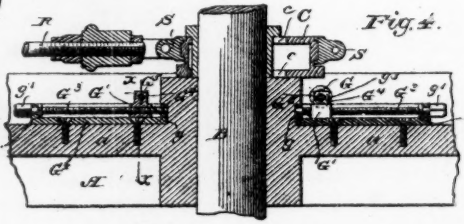


Fig. 5.

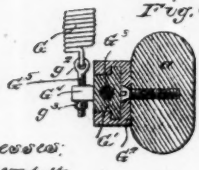
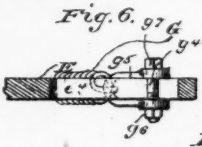


Fig. 6.



Witnesses:
Jno. H. Hewitt
C. C. Poole

Inventor:
Albert L. Ide
by W. E. Dayton
Attorney.

(No Model.) 3 Sheets—Sheet 3.

A. L. IDE.

STEAM ENGINE GOVERNOR.

No. 308,498. Patented Nov. 25, 1884.

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Ball Engine
Co. et al.
} p. 280.

Fig. 8.

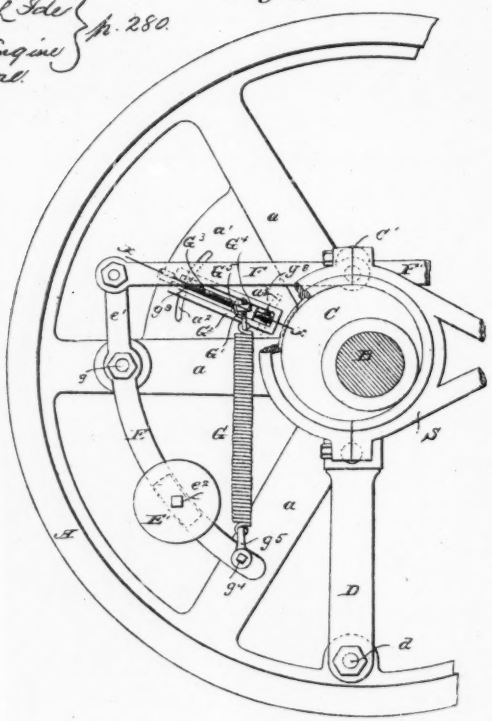
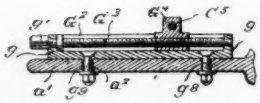


Fig. 9.



Witnesses
Jno. H. Stinchcomb.
C. C. Poole

Inventor
Albert L. Ide
by W. E. Dayton
Attorney

281 UNITED STATES PATENT OFFICE.

ALBERT L. IDE, of Springfield, Illinois.

Steam-Engine Governor.

Specification forming part of Letters Patent No. 308,498, dated November 25, 1884. Application filed April 25, 1884. (No model.)

To all whom it may concern:

Be it known that I, Albert L. Ide, of Springfield, in the county of Sangamon and State of Illinois, have invented certain new and useful improvements in steam-engine governors; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of steam-engine governors known as "fly-wheel" governors, or those which comprise a laterally-movable eccentric upon the crank-shaft of the engine and centrifugally-acting weights operating in connection with centripetally-acting springs, to vary the position of the said eccentric, so as to regulate the movements of the valve, and thereby produce a uniform speed in the engine.

The object of the invention is to provide an improved construction in such governors, whereby the force or tension exerted by the springs may be readily and accurately adjusted with reference to the opposing force exerted by the centrifugal action of the weights; and it consists in the matters hereinafter set forth, and pointed out in the claims.

In the accompanying drawings—

(Here follow diagrams marked pp. 278, 279, & 280.)

Figure 1 is a side elevation of a fly-wheel governor constructed in accordance with my invention. Fig. 2 is a section of the pulley on the indirect line *x x* of Fig. 1. Fig. 3 is a section of the pulley and other parts on the indirect line *y y* of Fig. 1. Fig. 4 is a fragmentary section of the pulley and other parts taken upon line *z z* of Fig. 1. Fig. 5 is a detail sectional view taken upon line *x x* of Fig. 4. Fig. 6 is a detail sectional view taken upon the line *x' x'* of Fig. 1. Fig. 7 is a detail sectional view taken upon line *y' y'* of Fig. 1. Fig. 8 is a detail view showing another form of device embodying my invention. Fig. 9 is a detail section taken upon line *x x* of Fig. 8.

As shown in the drawings, A is a pulley or balance-wheel having arms *a*, and secured by a central hub to the shaft B.

C is an eccentric having a slot or opening, *c*, through which the shaft B is inserted; and D is an arm attached to the eccentric and supporting it from the body of the pulley by a pivot-pin, *d*, shown

in Figs. 1 and 3 as being secured to the pulley A at a point adjacent to the outer rim of the said pulley.

S is the eccentric-strap applied in any approved manner to the eccentric and joined with the valve-rod R.

E E are two levers fulcrumed by means of pivot-pins *e* to opposite points of the pulley A and constructed to swing in a vertical plane, and E′ are weights which are adjustably secured to said levers. The weight-levers project in opposite directions from the pivot-pins, so that the weights E′ thereon, when properly located, stand at diametrically-opposite points of the pulley and counterbalance each other. One of the levers E is extended beyond its fulcrum *e* by a short arm, *e′*, and to the extremity of the said arm *e′* and to the opposite lever, E, at a point an equal distance from the fulcrum thereof, are pivoted the outer ends of the two connecting-rods F F′, whose inner ends are pivotally joined to the eccentric C, preferably by means of a pin, *f*, inserted through the said rods, and a lug, C′, located on the eccentric at a point opposite the supporting-arm D, said rods F F′ being arranged substantially in a line with each other and at right angles with said supporting-arm.

Near the free ends of the levers E, and at points equally distant from their fulcra, coiled springs G are connected therewith, and the opposite ends of the said springs are attached to the pulley near the end thereof.

H is a dash-pot which is provided with a suitable piston and piston-rod, the cylinder of the dash-pot and the piston thereof being connected, respectively, with the extremity of one of the arms E and with the wheel, so as to control or regulate the movement of said arms, in the manner fully set forth in an application for letters patent of the United States for which application was made by me on the 11th day of July, 1883.

It will be observed from the construction and location of the arms E and the connecting-rods F F′, above described, that the lever E, which is provided with the arm *e′*, for the attachment of the
282 connecting-rod F, operates, when the weight E′ thereon is thrown outwardly by centrifugal force, to thrust the connecting-rod F inwardly, and to thereby carry the eccentric laterally upon the crank-shaft, while the other lever E operates, through the medium of the connecting-rod F′, connected therewith, to pull upon the eccentric in the same direction in which the rod F tends to move it. The points of connection between the connecting-rods F F′ and the arms E being in both cases the same distance from the pivotal points of said arms, it is obvious that the weights E′, when placed at equal distances from the pivotal points of both arms, will operate with the same force to move the eccentric.

The several parts of the governor hereinbefore described are constructed and operate substantially in the manner set forth in the application for letters patent of the United States before referred to as made by me on the 11th day of July, 1883, and now pending. Such parts do not, however, with the exception of the dash-pot hereinbefore referred to, form the subject-matter of claims in said ap-

plication, the parts of the governor considered to be new being claimed herein.

In governors constructed in the manner above described the position of the eccentric is determined by the opposing and self-balancing forces exerted by the centripetally-acting springs and the centrifugally-acting weights connected with said springs, the intention being to hold the eccentric permanently in a certain position for a given speed of the wheel, and to vary the position of the eccentric exactly as the speed of the wheel is varied. A change in the speed of the engine will obviously be accomplished either by shifting the weights upon the levers, so as to bring them nearer to or farther from the fulcra of the levers, or by changing the tension of the springs. The means herein shown for adjustably securing the weights upon the levers preferably consist of tap-screws e^2, inserted through the sides of the weights E′, and constructed to abut against blocks e^3, which rest against the levers and are placed in recesses e^4 in the weights, the purpose of the said blocks being to prevent the end of the set-screw from marring the surface of the levers.

In adjusting the governor for a certain speed the weights are moved to such points upon the levers that when the desired speed is exceeded the centrifugal action of the weights will overcome the force of the springs and the levers will move outwardly and produce the desired movement in the eccentric.

In order to obtain a sensitive action and accurate regulation with the class of governors described the weights and springs must be so adjusted that a slight variation in the speed of the wheel will cause an extreme movement of the weights, and in order to produce this sensitive action the weights must be relatively so adjusted that the resistance of the springs will increase just in proportion as the centrifugal force of the weights increases in their outward movement. Springs of equal size and proportion, on account of differences in temper and other causes, are not always of the same strength, and also act with different degrees of force when stretched to the same extent.

Means are usually provided for adjusting the length of the springs, so that they may be adjusted so as to operate with the desired effect in opposition to the weights when the latter are in their normal positions; but, inasmuch as the centrifugal action of the weights increases in the same proportion in all parts of their movement, it is impossible, by the use of the adjusting devices described only to so adjust the springs and weights that the resistance of the springs will vary exactly in proportion to the centrifugal force of the weights at all points in the movement of the latter.

I have found that by connecting the ends of the springs that are secured to the wheel in such manner that they may be adjusted thereon nearer to or farther from the pivotal points of the levers the resistance of the springs and the centrifugal force of the weights may be equalized in all portions of the throw of the latter. This result is obtained by such adjustment of the springs for the reason that when the ends of the said springs are placed close to the pivotal points of the levers the same amount of outward movement of the

weights will stretch the springs to a less extent, and the weights will operate with proportionately greater effect at the outer portion of their movement than when the springs are more nearly at right angles to the levers, so that by moving the ends of the springs nearer to or farther from the pivots of the levers while running the engine with light and heavy loads, and with a speed-indicator attached, a point can be found after a few trials where the resistance in the stretch of the springs will just equal the centrifugal force of the weights at all points in their outward movement.

It is obvious that the springs will act with less effect upon the levers as their points of attachment to the wheel are brought nearer to the pivotal points thereof, and it therefore becomes necessary to increase the tension of the springs by stretching them more tightly (so as to counteract the centrifugal action of the weights and to preserve the desired speed in the engine) when the springs are adjusted in the manner mentioned.

The adjustments of the springs above mentioned may be accomplished by any suitable or well-known construction in the connections between the said springs and the wheel; but as a preferred construction in such connections, they are, as herein shown, made as follows: The springs G, at their points of attachment to the wheel, are secured to sliding blocks G′, held in guides G², attached,
283 as shown in Figs. 1, 2, 3, 4, and 5, to opposite spokes *a* upon said wheel, said guides, as illustrated in said figures, being arranged radially of the wheel and in line with the pivot-pins *e* of the levers E, so that when the said blocks G′ are moved in the guides they will be carried nearer to or farther from the said pivot-pins. The blocks G′ are preferably held and moved in the guides G² by means of threaded shafts G³, having bearings at their ends in stationary projections *g*, attached to or forming part of said guides, said shafts being constructed to pass through threaded apertures in said blocks G, and provided upon their ends with square heads *g′*, by which they may be rotated and the blocks moved. The blocks G′ are preferably provided with projecting lugs G⁴, through a small aperture in which lugs are inserted threaded bolts G⁵, provided at one end with an eye, *g²*, in which the end of the wire composing the spring is inserted, and upon which is placed a nut, *g³*, constructed to rest against the lug G⁴, and by which the spring may be lengthened or shortened, and its tension thereby adjusted as desired.

In the operation of adjusting the springs and weights, when the parts are constructed as above described, the blocks G′, to which the inner ends of the springs are attached, are placed approximately in the position which they are usually found to take when finally adjusted and a spring of the same size is used, and the weights are then shifted upon the levers to points at which they will overcome the resistance of the springs and move the levers outwardly from their normal positions when the speed at which it is desired to run the engine is exceeded. After the weights and springs are adjusted in this manner, the blocks G′ are then moved in or out by rotating the shafts G³ until a point is found at which the greatest sensitiveness

is obtained—that is, a point at which a very slight increase above the desired speed will produce an extreme movement of the weights.

It is obvious that if the resistance of the springs increases relatively to the centrifugal force of the weights in their outward movement a greater increase of speed will be requisite to give the weights full throw than when the resistance of the springs varies exactly in proportion to the force of the weights, and the regulation will, therefore, in the first case be less sensitive than in the last. If, however, the spring is so adjusted that the centrifugal action of the weights increases to a greater extent than the resistance of the springs, the regulation will be too sensitive—that is to say, the weights will be thrown outwardly, so as to suddenly check the speed of the engine, when the springs will draw them inwardly, so as to again give too great a speed, and a vibrating movement in the weights will thus result. The most sensitive action is obtained when the blocks G′ are nearest the pivots of the levers, and in practice the said blocks are moved toward the said pivots in adjusting the springs until a point is reached at which the greatest sensitiveness is obtained that is possible without causing the vibratory movement in the weights above described.

In the form of device illustrated in Fig. 8 the guides G^2, instead of being arranged in line with the pivots e of the levers, as hereinbefore described, are placed upon the wheel with their ends which are adjacent to the said pivots at a greater distance from the points of attachment of the springs to the levers than their inner ends.

When the guides are located in the manner first described, it is necessary, in the adjustment of the springs, as before stated, to increase the tension upon the springs when the blocks G′ are moved toward the pivot-points of the levers in order to retain the desired strain upon the springs at such time, and by locating the guides with their outer ends more distant from the ends of the levers and the points of attachment of the outer ends of the springs than their inner ends, the inner ends of the springs, as the blocks G′ are moved outwardly, will obviously be carried away from the ends of the levers and the desired increase of tension given thereto without the necessity of a separate adjustment of the springs for this purpose.

The guides G^2 in the construction last described are preferably attached to the wheel by adjustable connections, so that their position may be changed thereon and they may be placed at any angle and with their outer ends at any distance from the ends of the levers desired.

As a preferred means of adjustably connecting the guides with the wheel, the said wheel, as shown in Figs. 8 and 9, is provided with flat webs a' in its portion between the arms a adjacent to the pivot-points of the levers, and the guides are secured upon the faces of said webs, the means of securing them thereon, herein shown, consisting of bolts g^8 and g^9, passing through apertures in the webs, as more clearly shown in Fig. 9.

The bolt g^8 adjacent to the hub of the wheel may be constructed to form a pivot for the inner end of the guide, and the bolt g^9 at the outer end of said guide may pass through a slot, a^2, concentric with

the bolt g^8, whereby the position of the outer end of the said guide may be shifted, and it may be placed at any desired angle upon the wheel. The bolt g^8 may also be inserted through a slot, as indicated in dotted lines at a^3 in Fig. 8, so as to permit a bodily adjustment of the guide.

When the inclined guide G^2 last described and shown in Figs. 8 and 9 is used, it obviously becomes unnecessary to also use the eye-bolts G^5 and nuts g^3 or other adjusting device for increasing or decreasing the tension of the spring when the inner end of the latter is adjusted nearer to or farther from the pivot-point of the
284 lever; but in practice such device for adjusting the tension of the spring is preferably used in connection with said inclined guide in order that slight differences in the length or stiffness of the springs used may be readily compensated for in the first adjustment of the parts.

It is found desirable to connect the springs G with the levers by devices constructed to permit them to be adjusted longitudinally thereof, whereby a considerable change in the tension of the springs may be quickly accomplished as may be necessary in the first adjustment of the governor for operation, or when the weights are shifted upon the levers.

A preferred construction in the means for connecting the springs with the ends of the levers whereby the adjustment mentioned may be accomplished is illustrated in Figs. 1, 2, 3, and 6, in which the end portion of each arm E exterior to the weight E′ is provided with a longitudinal slot, e^4, through which is inserted a bolt, g^4, the end of which bolt at either side of the lever passes through suitable apertures in the ends of a yoke or clevis, g^5, to which the outer end of the spring G is secured. This construction is more clearly illustrated in Fig. 6, the bolt g^4, as therein shown, being inserted through the slot e^4 and the end of the clevis, the latter being clamped to the lever by means of a nut, g^6, operating in connection with a head, g^7, upon the opposite end of the bolt.

The object of the construction described, whereby the spring is connected with the lever through the medium of the yoke or clevis g^5, is to cause the said spring to act in a direct line upon the lever so as to have no tendency to twist said lever, as would be the case were said spring attached at one side thereof.

Any location or arrangement of the devices connecting the springs with the wheel that will permit a transverse movement of the inner ends of the springs, or one by which said inner ends may be shifted to points nearer to or farther from the pivot-points of the levers, will obviously produce the same effect as the one shown; and the invention as set forth in the appended claims is not, therefore, limited to the particular features of construction herein shown as one means of carrying out said invention except in the claims in which such features of construction are specifically set forth.

I claim as my invention—

1. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight-lever, E, connected with the said eccentric, of a spring, G, connected at its ends with the free end of

the lever and with the fly-wheel, and having its end that is attached to the fly-wheel adjustable upon the latter nearer to or farther from the pivot of the lever, substantially as and for the purpose set forth.

2. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight lever, E, connected with the said eccentric, of a spring, G, connected at its ends with the lever and wheel, said spring having adjustable connections with the wheel and lever whereby its tension may be varied, and having its end that is attached to the wheel also adjustable upon the latter nearer to or farther from the pivot of the lever, substantially as and for the purpose set forth.

3. The combination, with the fly-wheel A, a laterally-movable eccentric, C, and a pivoted weight-lever, E, connected with the said eccentric, of a block, G′, movably attached to the wheel and adjustable thereon nearer to or farther from the pivot of the weight-lever, and a spring, G, attached at its outer end to the free end of said lever, and having adjustable connection with the said block, substantially as and for the purpose set forth.

4. The combination, with the fly-wheel A, the laterally-movable eccentric C, and a pivoted weight-lever, E, connected with the said eccentric, of a guide, G^2, secured to the said wheel, a block, G′, adjustably held in said guide, and a spring, G, connected with the free end of said lever and with the said block G′, substantially as and for the purpose set forth.

5. The combination, with a fly-wheel, A, the laterally-movable eccentric C, and a pivoted weight-lever, E, connected with the said eccentric, of a guide, G^2, secured to said wheel with its outer end at a greater distance from the free end of the lever than its inner end, a block, G′, movably secured in said guide and adjustable longitudinally thereof, and a spring, G, connected with the free end of said lever and with the said block G′, substantially as and for the purpose set forth.

6. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight-lever, E, connected with the said eccentric, of a guide, G^2, adjustably secured to said wheel, a block, G′, movably secured in said guide and adjustable longitudinally thereof, and a spring, G, connected with the free end of said lever and with the said block G′.

7. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight-lever, E, connected with said eccentric, of a guide, G^2, pivotally connected with the said wheel at one end and adjustably secured thereto at its opposite end, a block, G′, movably secured in said guide and adjustable longitudinally thereof, and a spring, G, connected with the free end of said lever and with the block G′, substantially as and for the purpose set forth.

8. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight-lever, E, connected with said eccentric, of a guide, G^2, upon the said wheel, a movable block, G′, a threaded shaft, G^3, having bearings upon the wheel, and engaged

with a threaded aperture in the block, and a spring, G, con-
285 nected with the free end of the lever E and with the said block, substantially as and for the purpose set forth.

9. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight-lever connected with the said eccentric, of a spring, G, connected at its ends with the free end of the lever and with the fly-wheel, and having its end which is connected with the lever adjustable longitudinally of the latter, substantially as and for the purpose set forth.

10. The combination, with a fly-wheel, A, a laterally-movable eccentric, C, and a pivoted weight-lever connected with the said eccentric, and provided with a slot, *e*, in its free end, of a spring, G, connected at its inner end with the wheel, a clevis, g^5, affording attachment for the outer end of the spring, and a bolt, g^4, passing through the slot and clevis, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

ALBERT L. IDE.

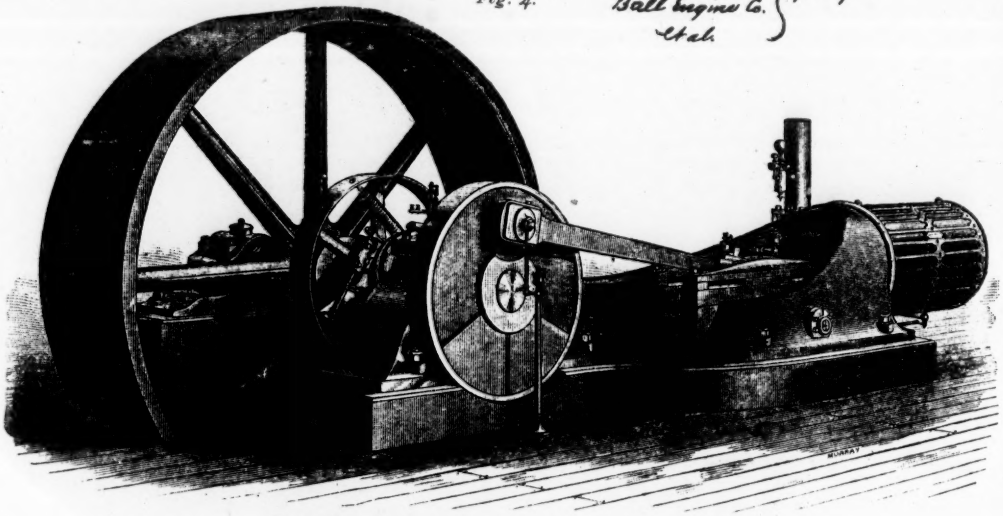
Witnesses:

C. CLARENCE POOLE.
OLIVER E. PAGIN.

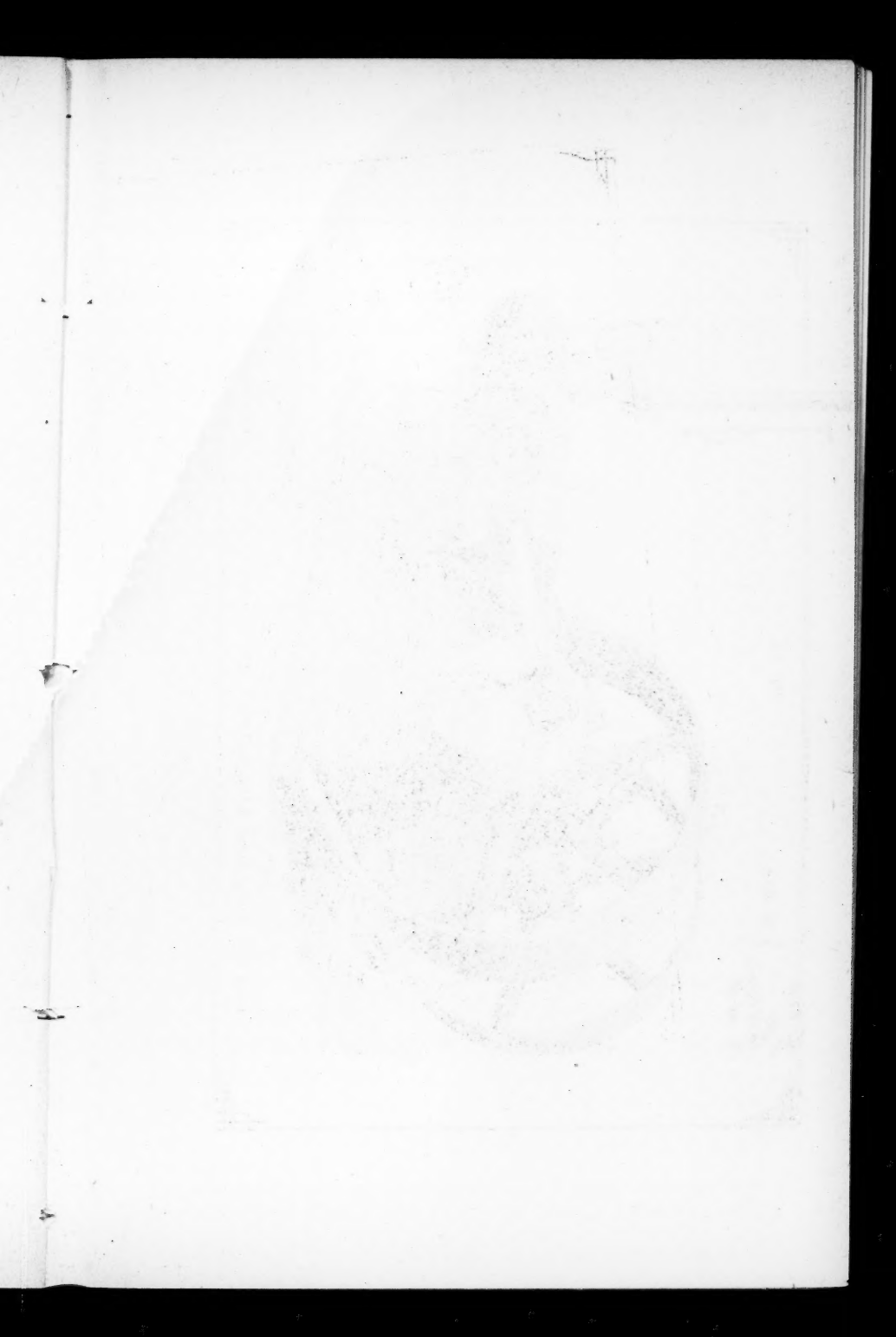


Fig. 4.

No. 227
Ide
&
Ball Engine Co.
Utah.
} p. 295.

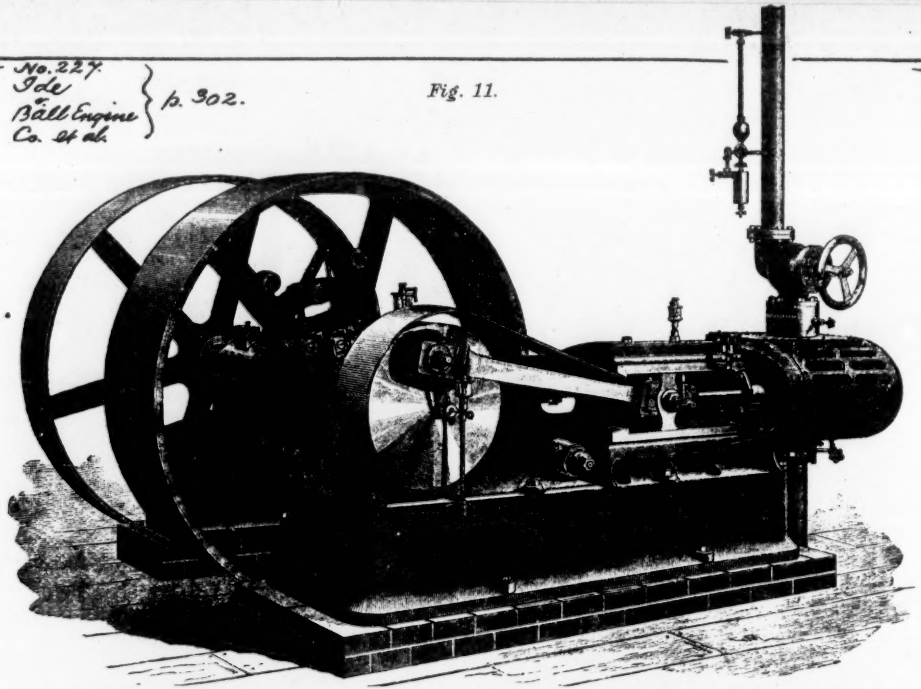


Front View, Tangye Bed, or Style B. (Table, page 20.)



No. 227.
Ide
Ball Engine
Co. et al.
p. 302.

Fig. 11.



Front View of High-Speed Automatic, Style C, With Sub-Base, Single Valve. (Table, page 21.)

286–312 COMPLAINANT'S EXHIBIT BUCKEYE ENGINE CATALOGUE. Frederick C. Goodwin, Notary Public.

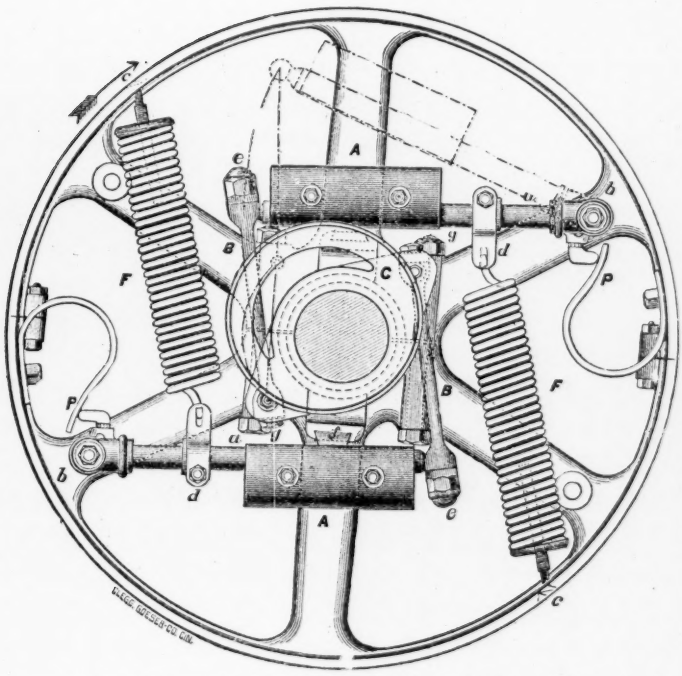
The Buckeye engine. Manufactured by Buckeye Engine Co., Salem, Ohio.

* * * * * * *

(Here follow diagrams marked pp. 295 and 302.)

313 *The Governor.*

Fig. 15.



The Buckeye Engine Company's isochronal regulator. Thompson & Hunt's patent, June 18th, 1878, and Thompson's reissue patent, September 24th, 1878.

This governor is virtually the pioneer in the market of the class to which it belongs (now quite numerously represented), which has come to be known as the "shaft governor" from its being mounted upon the shaft of the engine.

Its superiority in respect to appearance, convenience, sensitiveness, certainty of action, and, above all, safety from detachment,

over all forms driven by belts or other intermediate machinery is now almost universally recognized.

It is so simple in plan and construction and so clearly shown in the cut, Fig. 15, and has been so thoroughly familiarized to the public through mechanical periodicals and standard works and through the thousand or so in actual successful use that only a brief outline description here is needed.

Arms *a a* are pivoted to the containing wheel at *b b* and connected at their other ends by links *B B* to ears on loose eccentric *C* in such manner that their outward movement to the position indicated by the dotted lines near one of them turns the eccentric on the shaft about one-quarter of a revolution in the direction the engine runs—that is, "advances" it. The direction of rotation is indicated by the arrows.

The arms are thrown outward by centrifugal force in opposition to the force of springs *F F*.

314 They are loaded with more or less weight at *A A* according to the speed desired, the required effective weight, arm, and all being, other things equal, in inverse proportion to the square of the speed in revolutions in a given time.

The tension of springs *F F* is adjusted by screws *c c*. The amount of tension to be given them is determined by the amount of variation of speed due to variation of load; the more tension the less such variation up to the point of almost absolute isochronism under favorable load conditions, beyond which unsteadiness of equilibrium would result.

The auxiliary springs *P P* were introduced a few years ago to obtain the refined closeness of regulation required for electric lighting. For reasons that we have not space to explain, the amount of tension required to give the closest possible regulation could only be carried while the arms were in the outer half of their range of movement. In the inner half it would be in excess, causing unsteadiness. The auxiliary springs tend to throw the arm outward, but act only through the inner half of movement range, leaving contact with the fingers on which they act in mid-movement.

Their force is made such that when the proper tension is given to springs *F F* to give best results, when the arms are in the outer half of their movement range they will start out on starting the engine before the normal speed is exceeded and the regulation will be steady at all loads.

When they are applied the tension of *F F* must be greater than could be carried without them, otherwise the variation of speed would be increased instead of diminished, and the same result would follow if their force were too great, as would be known by the arms starting outward at a speed too much below the normal or by too much loss of speed at heaviest loads. For most purposes sufficiently good regulation could be had without them, but they are now always furnished; hence the importance of a clear understanding of the conditions required for getting the full benefit of them. To recapitulate, they are, first, as much tension on the main springs as can be carried without loss of steadiness, which will gen-

erally be about one-third to one-fourth more than can be carried without them; second, that they shall have just sufficient force to start the arms out at very nearly the proper speed, and, third, that they shall leave contact at about mid-movement. Any considerable departure from either of these conditions will defeat their object.

The direction of motion required for the arrangement of parts shown is indicated by the arrow. The parts can be readily changed, however, for motion in the opposite direction. To accomplish this, the pivots of the arms are removed to the unoccupied holes shown and the other parts changed to correspond, so that the arrangement will correspond exactly with a view of the cut as it would appear held up to a strong light and viewed from the back.

Then a new angular position on the shaft is required. The following rule, however, will place it as nearly correct as it
315–340 can be placed in the absence of any knowledge of special conditions and for either direction of motion: When the arms rest on their inner stops, as shown, the eccentric "*C*" and the crank should pass their dead centers at the same time and in the same direction.

When a condenser is attached the position may require to be a little in advance of this. On the other hand, when the engine is heavily loaded and not liable to be run without load it may be back of it; but the test of the correctness of its position is that it shall have no more advance than is necessary to hold the engine to speed under its lightest load and highest pressure.

Changes of speed should always be made by changes of the amount of weight attached at *A A*, though slight changes may be made by shifting the weights along the arms, and also by the changes of the tension of springs *F F*, provided increase of tension does not cause loss of steadiness or diminution does not introduce objectionable variation of speed with changes of load and pressure.

When all the adjustments are properly made (and any intelligent engineer can readily make them, if necessary, from the hints given above) the regulation will be sufficiently perfect for the most exacting demands, whether in electric lighting, mills, factories, or what not.

Conditions outside of the engine itself tending to make fine regulation difficult or otherwise vary greatly in different cases; hence no precise statement of what can be accomplished can be made without qualification as to such conditions; but, generally speaking, we feel entirely warranted by extensive experience in promising fully as good regulation as could be had under existing conditions by any known device.

It is very seldom that as much as 2 per cent. of variation from load changes is the best that can be attained, while under favoring conditions it has in numerous cases been reduced to so small a fraction of 1 per cent. as to be inappreciable.

Whenever from any cause regulation is not satisfactory, either from unsteadiness or too great variation of speed from load changes, we stand ready to make it so by instructions or otherwise, as may be necessary, knowing by experience that satisfaction can always be given.

341 U. S. Circuit Court, Northern District of Illinois. In Equity.

ALBERT L. IDE
vs.
BALL ENGINE COMPANY *et al.*

Depositions taken by agreement at Salem, Columbiana county, in the northern district of Ohio, this 3d day of May, A. D. 1888, at 6 o'clock p. m., before me, Byron S. Ambler, a notary public within and for said Columbiana county, Ohio, residing at the city of Salem, in said northern district of Ohio, at my office, on Main street, Salem, Ohio.

Present: C. K. Offield, Esq., on the part of complainant, and J. K. Hallock, Esq., on the part of defendants.

And thereupon the following proceedings were had before me per agreement:

JOSEPH W. THOMPSON, a witness produced on behalf of the respondent, being duly cautioned and sworn to testify to the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by JOHN K. HALLOCK, Esq.:

Question 1. Please state your name, age, residence, and occupation.

342 A. My name is Joseph W. Thompson; I am fifty-five years of age; I reside in Salem, Ohio, and I am by occupation a mechanical engineer, in the employ of the Buckeye Engine Company of Salem, Ohio.

Q. 2. How long have you been employed by the Buckeye Engine Company?

A. Thirty-five years, and its predecessors.

Q. 3. Who was the designer and inventor of the steam-engine made by said company at the present time and known as the Buckeye engine?

A. I was the designer myself, so far as its mechanical principles are concerned.

Q. 4. I now hand you a blue print of a drawing. Please state what it is.

A. It is the drawing of a governor of a Buckeye engine, such as referred to in former question, with certain appliances attached.

Q. 5. Was that blue print made from the original working drawing?

A. It was; but my certainty in regard to that arises from the fact that the process employed produces an exact copy, and I recognize the print as an exact copy of the drawing made by me some time ago.

Defendants' counsel offers the drawing in evidence referred to in the last two questions, and the same is marked "Defendants' Exhibit A."

Complainant's counsel objects to this exhibit as incompetent, irrelevant, and immaterial and not the best evidence.

Q. 6. Please state what the letters and figures in the center of the figure on the right of that drawing mean.

A. The reading referred to is as follows: "No. 6 governor," which No. 6 refers to largest size, being the largest size we make. "With oil piston details;" that means that a certain appliance is added to the governor over and above its usual construction, consisting of a cylinder to which is fitted a piston and rod, which
343 rod is attached to the moving arm of the governor in such manner that the piston could be moved in the cylinder by the action of the governor. The term "oil piston" refers to the fact that it was the intention and practice to put oil in the cylinder on both sides of the piston to retard its movement and compel it to move slowly. The rest of the inscription referred to in drawing is as follows: "Scale 3″=1 ft., Jan. 22, 1881." I recognize that date and remember it as the date on which the drawing from which this blue print was taken was finished.

Objected to as incompetent and irrelevant.

Q. 7. Was a governor made in accordance with that drawing?

A. Not that I remember of, in the works. The oil piston and cylinder referred to in former answer was made in our works and sent away to be applied to a governor made in accordance with the drawing.

Q. 8. When was the first oil piston made to which you refer in your last answer?

A. I cannot tell further than to say that my recollection is that at the time the drawing from which this print was taken was made there had been several made and applied to the governors of Buckeye engines, but cannot state definitely when they were made, but I think this was the first we made in the Buckeye works; the others were made elsewhere by other parties.

Q. 9. Were any oil pistons made as represented in that drawing and applied to Buckeye engine governors within a year from the date given in that drawing?

Objected to as entirely leading and suggestive.

A. I don't understand the term within a year; previous or subsequent?

Q. 10. How long would you say it was after the date of that drawing that an oil piston like that represented in the drawing was made to be applied to a Buckeye governor?

344 A. I cannot tell, but I remember the drawing was made to show the users of the engine how to apply the oil piston, and that the piston was made about the same time or, at any rate, not long after.

Q. 11. Will you please point out in the figure on the right of that drawing the part which you designate as an oil piston and state what letters there are on that part?

A. The letters on the point in question read as follows: "Put leak hole in this side." The meaning of these words is that a small hole was drilled through the piston to allow the oil to pass, so as to allow a slow movement. The side designated is the side farthest from the center of motion. The object of the instruction was to have the leak hole at the side where the oil would collect from centrifugal force, so that the leakage through the hole would be oil and not air in case the cylinder was not entirely full of oil.

Q. 12. Will you please state what the second figure from the right-hand side of that drawing represents?

A. It represents the part in question, namely, the oil cylinder and piston, shown in section on a larger scale, together with the parts necessary to attach it to the governor.

Q. 13. Is the part which you have called an oil piston and an oil cylinder and piston known to mechanics by any other name; if so, what?

A. I have frequently heard such contrivances called dash pots for short and have so designated them myself.

Q. 14. I now show you a model; please state what it is.

A. It is a model of a governor, identical substantially in principle and construction with the governors built by the Buckeye Engine Company and applied to their engines, known as Buckeye engines.

Q. 15. Please state what that cylindrical part is which lies
345 parallel nearly with one of the springs and is connected to one of the spokes of the wheel at one end, and has a rod working into it which is connected pivotally with one of the weight arms.

A. From its external appearance it conforms to the part described in my former answer as the oil cylinder and piston shown on the blue print, but I cannot see its internal construction.

Defendants' counsel introduces in evidence the model referred to in the last two questions, and the same is marked "Defendants' Exhibit B."

Complainant's counsel objects to this model as incompetent and irrelevant and immaterial.

Q. 16. Will you please compare that model with the drawing, Defendants' Exhibit A, and state whether or not it is a fair representation in outward appearance of the device delineated in the said drawing?

A. It is substantially the same, as far as can be seen, from external appearance. The differences are minor and immaterial.

Q. 17. Please state whether or not, to the best of your knowledge and belief, Buckeye engine governors had been constructed and used having the construction shown in Defendants' Exhibit A and B prior to July 11, 1883.

Last objection repeated; also as leading.

A. Properly speaking, there were none constructed like these exhibits at the works—that is to say, with the oil piston applied—

either prior to that date or at any time; but, as before stated, an oil piston was made at or about the date of this drawing, to be applied to a governor previously made and then in operation, but I cannot tell definitely as to the dates of any others. My recollection is that I made this drawing and obtained the details of the oil piston from sketches sent to the company by a former employé of the works, who stated he had made and applied them successfully to other engines.

346 Q. 18. Who was that employee?

A. His name as he signed it was E. H. Schneider. I can't tell what his full name was.

Q. 19. Will you now please state what you understand to have been the object and purpose of applying the dash pot or oil cylinder and piston to a governor as shown in the drawing and model before you?

A. It was to restrain undue movements of the working parts—that is to say, to compel them to move slowly.

Q. 20. I now show you a Patent Office copy of the patent in suit. Will you please examine the same and note the objects of the invention stated in the specification, and then compare the same with the device shown in Defendants' Exhibits A and B and state what, if any, similarities you find with regard to the manner of applying and the objects for applying the dash-pot attachments?

Objected to as incompetent, no foundation having been made for the subject-matter of said question.

A. I will confine my answer to the part designated as the "dash pot" in the patent in question. I find it to consist of a cylinder and piston, the rod of the piston being attached to the weight arm of the governor pivotally and the closed end of the cylinder similarly attached apparently to a link or connecting rod connecting the two weight arms together and to a swinging eccentric in such manner that the movements of the said weight arms causes the piston to move in the cylinder. In that respect the two, namely, the defendants' exhibits and the patent in question, are alike. The incidental differences are, first, the manner of attaching the cylinder itself to a moving part instead of to a containing wheel, and that the point of attachment of the piston to the weight arm is such as to give it greater movement. As to the object for which the de-

347 vice in question is introduced, — is "to prevent sudden movements of the weight levers," which I understand to mean the same as the words "undue movements" used in my former answer, namely, movements more sudden or rapid than required by or consistent with perfect regulation.

Cross-examination by C. K. OFFIELD, Esq.:

X Q. 1. When, where, and who made Defendants' Exhibit B?

A. I don't know.

X Q. 2. When was the first time you saw this exhibit?

A. Three or four hours ago.

X Q. 3. Do you know what the spoke wheel was made for, inside of which the devices contained in this exhibit are located?

A. I do not, but it appears to be a common pulley, the pattern of which has been adapted to the purpose.

X Q. 4. Have you intended to state or intimate that this Defendants' Exhibit B is made to any scale?

A. I have not.

X Q. 5. Who made this blue print, Defendants' Exhibit A?

A. If it is one of the prints I saw made from that drawing, it was made by William Cope, who does such work for the Buckeye Engine Company.

X Q. 6. Did you make it?

A. No; I did not make it.

X Q. 7. How long has it been since you saw the original drawing, from which you have stated this blue print was made?

A. I cannot tell exactly; it may have been several months.

X Q. 8. Where is that drawing now, and is it in your control?

A. I think it is in a package, along with other governor drawings, at the Buckeye works, but it is not under my control or care especially.

348 X Q. 9. It could have been produced here and examined, if desired, could it not?

A. It could.

X Q. 10. Mr. Thompson, have you ever personally or of your own knowledge seen and known the devices shown in the two defendants' exhibits applied or put to any use upon any engine made by the Buckeye Company or any other engine of any make or construction?

A. I have not, except that I have frequently seen dash pots operating on similar principles attached to the pendulum governors of Corliss engines and others of similar construction.

X Q. 11. As I understand you, neither yourself, the Buckeye Company, or any other party, to your knowledge, ever constructed devices like these two defendants' exhibits. Please understand that I do not ask for hearsay or statements of others to you.

A. Well, with the sweeping exclusion, all statements of others, verbal or written, I must answer the question in the negative. The extent of my knowledge and experience is contained in my foregoing answers.

X Q. 12. As I understand you, the engines to which you think the devices of Exhibits A and B have been attached are engines which the company built, sold, and delivered for use at points distant from this city. Is this correct?

A. It is correct.

X Q. 13. And such engines were built, sold, and delivered by the Buckeye Company as entire, complete, and perfectly operating engines, were they not?

A. They were.

X Q. 14. As we are relying somewhat on your understanding in distinction from your actual personal knowledge, is it not a fact that each engine to which you understand devices similar or like

the two defendants' exhibits were attached were so attached
349 for the purpose of curing a defect in such engines and making them practically operative for the purposes desired?

A. They were. They were applied to make them more perfectly operative in respect to steadiness of regulation.

X Q. 15. Did and does the catalogue and circulars of the Buckeye Engine Company contain faithful cuts and representations of the engines manufactured and sold by the Buckeye Engine Company, to which you have understood devices like Exhibits A and B were attached? I mean the catalogues for the years 1881, 1882, 1883, and 1884.

A. They do; that is to say, they correctly represent the parts as they were made at the time the engravings used were ordered.

X Q. 16. Do you know of your own knowledge whether the drawing from which the defendants blue print, Exhibit A, is supposed to be taken has been altered or changed in any respect from its condition as originally executed?

A. I am not aware of any change having been made in it. I do not think there has been. It was made expressly to show the application of the oil cylinder in question; in other respects it was a copy from drawings previously made. I made the drawing myself.

X Q. 17. Was this drawing made for any particular engine?

A. I think it was made for one or both of a pair of engines in the Pacific mills, Lawrence, Mass., although I cannot entirely trust my memory; but such is my impression.

X Q. 18. Mr. Thompson, in an affidavit made by you in preliminary proceedings in this case, you swore as follows to a drawing there, marked Exhibit A: "This drawing was made for a shaft governor on an engine we sold to the Pacific mills, at Brooklyn,
New York, and the dash pot was put on the governor within
350 a few weeks of the date of the drawing. The Buckeye Company also put similar dash pots on several other shaft governors about this time." Was this statement correct, as made in that affidavit, or did you then understand that you were stating in effect what you are now stating in this deposition?

Counsel for defendant- calls attention to the fact that there has been no preliminary proceedings in this case, but in another case between the same parties, which has been dismissed by mutual consent.

A. As to the locality of the Pacific mills, I was aware then as now that they were in Lawrence, Mass., and my stating that they were in Brooklyn must have been a slip of the tongue, growing out of the fact that the device in question was as represented to me first applied in Brooklyn, or by Mr. Schneider, whose house is in Brooklyn. If I made this mistake, I did not notice it then and was not aware of it. That affidavit was correct according to my recollection and meaning then, but, to speak from exact personal knowledge, I only know of a few having been made in the works to be sent out for applications on engines already in operation, and I think all of

them from instructions or specifications from the party already referred to, Mr. Schneider.

X Q. 19. Did you ever take out a patent for a shaft governor?

A. I have; two or three.

X Q. 20. Can you give their number or dates?

A. Not from recollection.

X Q. 21. Will you give to the notary, before he attaches his certificate to this deposition, the numbers and dates of your patents as a part of this answer?

Defendants' counsel objects to this line of interrogatories, first, because it is not cross-examination; second, because the matter inquired of is a matter of public record, officially and legally, and the counsel can inform himself from the public record.

351 A. I will.

It is agreed between counsel that the notary shall obtain this information and forward the same to New York, to defendants' counsel, to be by him inserted herein, defendants' counsel, however, not waiving his objection.

X Q. 22. As I understand you, the devices which you think were put in the Buckeye engines, like Defendants' Exhibits A and B, were put in engines with shaft governors, were they?

A. They were.

X Q. 23. Did the Buckeye Company ever make any other engines except those having shaft governors?

A. They have made a number without shaft governors.

Redirect examination:

R. D. Q. 1. Do you understand when you use the term "shaft governor" that it means the same thing as "fly-wheel governor"?

Objected to as wholly leading and suggestive to the witness of a desired answer.

A. By a shaft governor I understand is meant a governor placed on the main shaft of the engine, or adapted to be so placed. If it serves also as a fly-wheel it becomes then a fly-wheel governor, but it is also still a shaft governor for reasons before stated.

R. D. Q. 2. Supposing the governor is put within the driving wheel of the engine, which is on the main shaft, then what?

A. It is still a shaft governor, and if the driving wheel referred to is a fly-wheel it may be a fly-wheel governor also; otherwise there is no name in common use for it, but it might be called, on the same principle, a driving-wheel governor; but I prefer the term shaft governor, as more comprehensive, as it includes all the cases named.

R. D. Q. 3. Is not this type of governor designated sometimes as a "shifting eccentric" governor?

352 A. I have heard it so designated sometimes, but not frequently. The term is descriptive of the nature of the class of governors alluded to.

R. D. Q. 4. You say you made the original drawing yourself. Can you not recognize this blue print, Defendants' Exhibit A, as having been made from that drawing?

A. Yes; I do recognize it as having been made from that drawing, both from the handwriting of the inscriptions and distinct recollection of the occasion on which it was made, as well as numerous other evidences.

R. D. Q. 5. State whether or not it is the practice of the Buckeye Engine Company to retain all original drawings.

A. They are preserved carefully, and, as a rule, not allowed to be taken from the works.

JOSEPH W. THOMPSON.

Sworn to by said Joseph W. Thompson before me and by him subscribed in my presence this 3d day of May, A. D. 1888, and, by agreement of counsel, certificate to this deposition is waived.

B. S. AMBLER,
Notary Public.

Received from Ball Engine Co. $5.25 for taking this deposition. May 3d, 1888.

B. S. AMBLER,
Notary Public.

SALEM, OHIO, *May 4th*, 1888.

John K. Hallock, Esq., Hotel Brunswick, New York city.

DEAR SIR: The following is a list of Joseph W. Thompson's patents on shaft governors, with dates and numbers:

No.	Date.	Remarks.
128,936	July 16, 1872	Crank-pin governor.
162,715	April 27, 1875	Regular shaft governor.
8,433	Sep. 24, 1878	Reissue of 162,715.
204,924	June 18, 1878	Thompson & Hunt.
353		
310,479	Jan'y 6, 1885	Single valve.
314,353	March 24, '85	Imp. on 162,715.
381,597	April 24, 1888	Variable eccent. travel.

Mr. Thompson also has two applications pending.

Very truly yours, B. S. AMBLER.

Depositions taken by agreement at the city of New York, in the county and State of New York, this 7th day of May, A. D. 1888, at 10 o'clock a. m., before me, E. R. McCarty, notary public within and for said city and county of New York.

Present: C. K. Offield, Esq., on the part of complainants, and J. K. Hallock, Esq., on the parts of defendants.

And thereupon the following proceedings were had before me per agreement.

HARRIS TABOR, a witness produced on behalf of the respondent, being duly cautioned and sworn to testify to the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by J. K. HALLOCK, Esq.:

Q. 1. Please state your name, age, residence, and occupation.

A. My name is Harris Tabor; I am forty-five years of age; I reside in New York city, and am superintendent of the Tabor Manufacturing Company.

Q. 2. What is the business of the Tabor Manufacturing Company?

A. Steam-engine governors and sand-moulding machines.

Q. 3. Please state what experience you have had as a mechanical engineer.

A. I was engaged with B. W. Payne & Son about thirteen years as workman and foreman; during that time I designed two governors and patented same, of the single-valve automatic type;
354 since then, during the year 1881 was superintendent of the Hartford Engineering Co., Hartford, Conn., engaged in building an engine which was known on the market as the "Buckeye Automatic," J. W. Thompson's patent; the following two years was superintendent of the Westinghouse Machine Co., Pittsburgh; while there I made their engine automatic; since 1884 have been engaged in my present business.

Q. 4. You are the inventor of an indicator, are you not?

A. I am.

Q. 5. For what purpose is the indicator named above used?

A. Principally for determining the power of steam-engines; it is also used for determining the economy of steam-engines, approximately, valve-setting, and the general distribution of steam.

Q. 6. Is that indicator being manufactured and sold; if so, to what extent?

A. It is manufactured under license by the Ashcroft M'f'g Co., and by them put on the market; can't give the exact amount of sales from memory, but there is in the neighborhood of 1,000 in use in this country.

Q. 7. How does your indicator stand in the estimation of steam engineers and how does it compare, as to the number sold, with other indicators for the same purpose?

A. I am unable to answer that question, as I know nothing of the sales of the other instruments; testimonials from users and repetition of orders from the same users leave me to think that it would compare favorably.

Q 8. Have you ever been sworn as an expert witness in patent cases pending before the courts?

A. I have not.

Q. 9. Have you ever been consulted as an engineer by manufacturers, users, or inventors of steam-engines, of steam-engine
355 governors, other than your employers, for the purpose of obtaining your advice as to questions relating to such machinery?

A. In a limited way, I have. I have never engaged in that profession any. When time has admitted I have, in a few instances, been engaged on tests as consulting engineer.

Q. 10. Are you a member of any scientific or technical society?

A. I am a member of the American Society of Mechanical Engineers.

Q. 11. To what extent in your past experience has it been necessary for you to compare mechanisms, and, by such comparisons, to understand and point out the similarities and differences between such mechanisms or to examine patents and determine, from their specifications and claims, questions of similarity or differences of the mechanisms patented with or from others?

A. The superintendency of the manufacture of three distinctly different types of engines and a fair knowledge of the various types in the market has led me into a careful analysis of this class of machinery. This has been extended over about twenty years. My knowledge of patent business and study of claims and specifications have been confined to my own patents and a few friends who have submitted such questions to me.

Q. 12. I now show you a Patent Office copy of the patent in suit, No. 301,720, dated July 8, 1884. Please examine the same and state whether you understand the construction there shown and described.

Objected to by complainant's counsel as incompetent and immaterial, not only as to the above question, but as to all questions relating to the same subject-matter, by reason of the preceding testimony of the witness.

A. I do.

Q. 13. Disregarding the dash pot shown in that patent and its connections and relation to the relatively movable parts of
356 the governor there shown, please state whether you were familiar with the construction there shown prior to July 11, 1883.

A. In 1879 and for a few years following B. W. Payne & Sons, Corning, N. Y., now of Elmira, manufactured and put on the market substantially the same device. The only difference I can recall now is the attachment of the spring to the weight arms. In this case the weight is between the pivot of the arm and the attachment of the spring to the weight arm. In the case of Payne & Sons' governor the spring was attached to the weight arm at some point between the weight and the pivot.

Complainant's counsel objects to the above answer and to all alleged facts stated therein as incompetent under defendants' pleadings in this case, no notice or allegation as to such alleged facts appearing in defendants' answer, and complainant's counsel, either before or at the hearing of this cause, will move to strike all testimony relating to this subject from the record.

Q. 14. Between the years 1879 and 1883 did A. L. Ide, the com-

plainant in this case, who is now present, have any connection with B. W. Payne & Sons; if so, what?

A. I have understood from Payne & Sons that at some time he was their agent, selling their engines in the Western market—I think during the years 1881 and 1882.

Q. 15. Did you ever hear Payne & Sons make complaint that A. L. Ide, when he began manufacturing engines, had copied their governor?

A. I have.

Complainant's counsel objects as wholly immaterial.

Q. 16. Who designed and invented the governor you refer to as made by Payne & Sons?

A. I did.

357 Q. 17. Now, please look at the patent in suit, No. 301,720, and state whether you understand the construction there shown of the dash pot, the manner in which it is applied, the objects for which it is applied, and the results obtained by its application.

A. I think I fully understand it.

Q. 18. State whether you have any knowledge of a similar application of a dash pot to the relatively movable parts of a fly-wheel governor prior to July 11, 1883; and, if so, state when and where the same was applied.

A. About the middle of the year 1881, while superintendent of the Hartford Engineering Co., we had a case of what is commonly called "racing" of governor on a pair of engines running in the Hartford Carpet Co., Thompsonville, Conn. I took the foreman of the machine shop with me to the factory and attempted to correct the trouble. We were unsuccessful. We then determined to put on dash pots filled with oil or similar fluid, as the Buckeye people had done in similar cases. Within a short time the dash pots were made, sent to the Hartford Carpet Co., and attached to the governor by their men. Mr. Steele, the engineer-in-chief, came to the shop a few days later and reported most excellent results from the application of the dash pots. So far as I know, the engines never gave trouble in the way of irregular motion after the adoption of the dash pots. Some time later in the same year we furnished an 18 x 30 engine to the Hartford Manilla Co., Burnside, Conn. In starting the engine we found difficulty in getting as close regulation as we desired and, at the same time, steadiness to the governor. The results at the Hartford Carpet Co. had been so satisfactory that I decided to put a dash pot in the governor of the Burnside engine as the better and cheaper way out of the difficulty, and I accordingly had it done. I believe the results there were equally satisfactory.

Q. 19. Do you wish to be understood as saying that both these applications you have just described occurred within the year 1881?

358 A. I do.

Q. 20. Please state what is meant by the technical term

"racing," which you have just used, when applied to a steam-engine governor.

A. An oscillating or vibrating motion to the governor weights. This occurs to such an extent in some cases that the weights will go through their entire range. This does not mean necessarily unsteadiness of motion—at least, to the extent that it may be counted or determined by the eye. It does mean, however, disastrous results to the engine on account of the intermittent strain due to the opening and closing of the valves on account of racing, and it is also detrimental to steam economy.

Q. 21. What do you understand to be the cause which gives this unsteadiness or oscillatory movements to the weights of the governor?

A. It may be due to various causes. Insufficient fly-wheel will sometimes produce this result. Frictional resistance of the moving parts of the governor, the inertia of the valve and its connections also tender to induce racing. This is particularly so when the governor has no interlocking device, such as eccentrics, cams, or quadrants.

Q. 22. Now, please look at the patent in suit and state what you understand from the specification to be the object and purpose of the invention there described and claimed—that is to say, what defects the device was intended to remedy as stated by the patentee in the specification.

A. As I understand the specifications, the object of the dash pot in the patent in question is to render *nil* any extraneous forces that may tend to give instability to the governor weights.

Q. 23. How does this object and purpose compare with the object and purpose you had in view when you applied the dash pots to the engines at the Hartford Carpet Co.'s and at the Hartford Manilla Co.'s works?

359 A. In each case the unsteadiness of the governor gave serious results. This was due to frictional resistance of the governor; friction and inertia of the valve and its parts, and to the additional friction in the packing in the stuffing box around the valve rod. The whole object in applying the dash pots was to overcome these defects, and in each case we succeeded. The object was the same as described in the patent specifications in question.

Q. 24. I show you now Defendants' Exhibit B. Please state if you know what it represents.

A. It is what is commonly known as a "Buckeye shaft governor," with the addition of a dash pot applied in one of the various ways used by the Buckeye Engine Co. of Salem, Ohio. In fact, this governor shows the application of a dash pot substantially as used by the Hartford Engineering Co. on some of their engines.

Q. 25. How does the construction shown in that model, so far as the application of the dash pot is concerned, compare with the application of the dash pot at the Hartford Carpet Co. and at the Hartford Manilla Co.?

A. The application of the dash pot was substantially the same.

There is this difference, however, in the governor. At the Carpet Co. and Manilla Co. each cut-off eccentric was counterbalanced by a weight attached to the light side of the eccentric. The model has no such counter-weight.

Q. 26. Please compare the manner of applying the dash pot as it was done at the Carpet Co. and the Manilla Co.'s Works with the manner of applying it as illustrated in the patent in suit, No. 301,720, and state what, if any, essential structural differences you find.

A. In each case the dash pot is attached to movable parts of a shaft governor, and in effect are the same. There is a structural difference in the points of application only. In the case of the Ide dash pot the attachment of the dash-pot piston rod or its
360 equivalent is at the end of the weight arm which has largest range of movement. In the Hartford cases the attachment of the dash pot to the weight arm was at some point between the outer end of the weight arm and its pivoted end. This would mean that in the Hartford case the dash pot or its piston, as the case may be, would have a lesser travel than in the case of Ide. To make the two dash pots equally effective, those used in the Hartford and Buckeye practice would need to be somewhat larger in diameter.

Q. 27. Now, please state, continuing the comparison, what, if any, difference you find as to objective results described in the Ide patent and those obtained by the Hartford construction or the construction represented in Defendants' Exhibit B.

A. The causes which rendered the application of the dash pots necessary in the Hartford cases were substantially the same as described in the Ide specifications—that is, extraneous forces, due to frictional resistance of the governor, friction of valve, which was unbalanced, valve-stem and the inertia of the various parts. The application of the dash pot in these Hartford cases had the effect of negativing these resistances which gave instability, and the result was excellent regulation, as reported to me.

Defendants' counsel introduces in evidence Patent Office copy of letters patent No. 358,829, dated March 8, 1887, issued to F. H. Ball for an engine-governing device, and admits that the construction shown in figuers 1 and 2 of that patent has been made and sold by the defendants. Said copy is marked Defendants' Exhibit C.

Complainant's counsel objects as incompetent and irrelevant.

Q. 28. Please look at Defendants' Exhibit C and state if you are familiar with the invention there described and claimed, and whether you understand the same.

361 A. I think I do.

Q. 29. Please state what you understand to be the object and purpose of the incorporation of a dash pot in the construction shown in said patent, Exhibit C.

A. I understand the dash pots used in combination with a spring to be for the purpose of giving a yielding base to the spring. In other words, a base that will change its position to suit the different positions of the weights, so that the spring may at all times be

under little or no tension and ready to give resistance in either direction. This dash pot or yielding base virtually changes what in the Ide patent would be the fixed end of the dash pot into a movable one.

Q. 30. Now, please look at the patent in suit, No. 301,720, and at the model, Defendants' Exhibit B, and state whether or not, in your opinion as a mechanical engineer, the objects named in the patent in suit as the purpose of the invention would be attained if the spring which you have referred to in your last answer was put in combination with the dash pot substantially as shown in the Ball patent, Defendants' Exhibit C, and in the model, "Complainant's Exhibit Defendants' Fly-wheel Governor." I have assumed in this question that the spring you referred to in your former answer and in the question is the spring marked E in the patent to Ball.

A. If the spring E shown in Ball's patent were to be used in combination with the dash pot shown in the Ide patent it would, in my judgment, yield in response to the inertia of the valve to a certain extent, and probably give instability to the weights if the springs in the Ide governor were drawn up to the theoretical initial tension. In this case the spring would destroy to a certain extent the rigidity given by the dash pot.

(Recess until 2 p. m.)

Cross-examination by C. K. OFFIELD, Esq.:

362 X Q. 1. Do you yourself claim to be an expert witness in relation to letters patent, either in regard to steam-engines or otherwise?

A. Not in the sense that a patent lawyer would consider an expert.

X Q. 2. Did you solicit your own letters patent which were taken out or did you employ a patent expert?

A. I employed patent solicitors.

X Q. 3. And that patent solicitor drew your specifications and formulated your claims, did he not?

A. Not altogether. In some case I rewrote them or portions of them.

X Q. 4. Can you identify by date and number the patents you have obtained relating in any manner to a steam-engine or any of its connecting parts?

A. No, sir.

X Q. 5. How many such patents have you obtained?

A. I have taken out three patents for shaft governors for steam-engines, two for throttling governors, one jointly on a throttling governor, one on steam-engine indicator, and three on details of steam-engine.

X Q. 6. Do these comprise the entire list called for by the preceding question?

A. I believe they do.

X Q. 7. Will you bring here to-morrow morning, at the adjourned hour, the number and dates of these patents respectively?

A. It's impossible. I can't get the dates in that time or the numbers. Some of them have gone out of my possession and I should probably have to obtain them through the Patent Office, some of them.

X Q. 8. Will you identify what you can, especially the shaft-governor patents?

A. The first two it would be impossible to identify at that time. There is not sufficient time to look them up. I may be able to put in one, the most recent, but I'm not sure.

363 X Q. 9. What years were these shaft-governor patents issued to you?

A. To the best of my recollection, 1878, 1879, and 1883, or, possibly, 1884.

X Q. 10. Will you obtain the dates and numbers of all of the letters patent taken out by you and have them attached by the officer to this deposition and made a part of the same before it is returned into court?

A. I will.

X Q. 11. Have the devices of any of your shaft-governor patents, as shown and described in such patents, ever gone into practical and public use?

A. They have.

X Q. 12. Who now owns those patents?

A. B. W. Payne & Sons, the first two; the third one is owned by the Taber Manufacturing Co. and D. M. Wightman jointly.

X Q. 13. Who now employs the devices of any of these shaft-governor patents in their engine construction?

A. The Morris machine works of Baldwinsville, N. Y., are using the last patent; the others, owned by B. W. Payne & Sons, have not been used since they abandoned the use of the piston valve and substituted an unbalanced slide valve and partially balanced side valve.

X Q. 14. When was that, approximately?

A. I can't give the date exactly, but I think in 1884, the latter part of the year.

X Q. 15. Your business now is the manufacture of steam-engine governors largely, is it not?

A. Throttling governors in part.

X Q. 16. Under what patent do you manufacture these governors?

A. Under patents issued to me.

364 X Q. 17. Patents before mentioned?

A. Before mentioned.

X Q. 18. What was the last year you worked for B. W. Payne & Sons?

A. I left there in the spring of 1881.

X Q. 19. What time in the spring?

A. I think the last of May.

X Q. 20. Where did you then go?

A. To the Hartford Engineering Co., Hartford, Conn.

X Q. 21. Immediately?

A. I did.

X Q. 22. What was the exact work you performed for the Hartford Engineering Co.?

A. General superintendent of works.

X Q. 23. What was the business of that company then?

A. Manufacturing what was then known as the "Hartford Buckeye engine" under license from the Buckeye Engine Co., Salem, Ohio.

X Q. 24. Was that the same kind of an engine that was being built at that time by the Buckeye Engine Co. at Salem?

A. With the exception of the engine bed.

X Q. 25. Can you state, even approximately, the number of steam-engines now in use in the United States?

A. I cannot.

X Q. 26. Can you state approximately the number in use in the city of New York alone?

A. I cannot.

X Q. 27. There are a number of thousands of them, are there not?

A. I presume so.

365 X Q. 28. Who built the "pair of engines" running in the Hartford Carpet Co. which you referred to in answer to direct question 14?

A. I think they were built by the Woodruff & Beach Co., of Hartford, Conn., afterwards rebuilt by the Buckeye Engine Co., of Salem, Ohio, who put on Buckeye cylinders, Buckeye shaft governors, and valve gear.

X Q. 29. In what year were these engines so rebuilt by the Buckeye Co.?

A. I am not sure, but I think in the year 1879 or 1880.

X Q. 30. Why were they so rebuilt?

A. I believe in order to obtain better steam economy, better regulation, and more power. My impression is that a guarantee of 25 per cent. better economy was given with the sale.

X Q. 31. What did you first do with your foreman to correct "the trouble" in this Carpet Co.'s engines that was unsuccessful?

A. We examined them carefully to see that there was no undue friction in the parts, then changed the counter-weight on the eccentric. I think nothing was done beyond that.

X Q. 32. How long did the engines run in that condition?

A. I can only say approximately. I began with the Hartford Engineering Co. the first of June and I think the dash pots were put in early in July.

X Q. 33. This is solely from your recollection?

A. Entirely.

X Q. 34. What was the size of the fly-wheels in the shafts of those two Hartford engines in 1881 and 1882?

A. I am unable to give that accurately.

X Q. 35. Approximately, as to size and weight?

A. As to size, approximately, 14 feet. I can give no answer as to the weight.

366 X Q. 36. What horse-power were these Hartford Co.'s engines, respectively?

A. I think their combined horse-powers when doing the regular work was about 300.

X Q. 37. Were the engines intended to be alike and equal as to size and power?

A. My impression is they were. My recollection of the cylinder is that each had a bore of 22 inches and a stroke of 48; the rotative speed of the engine was about 62 revolutions per minute. That is the best of my recollection.

X Q. 38. Was there ever any governor in either of the fly-wheels in those two carpet Co.'s engines, to your knowledge?

A. Not from personal observation. Each engine had a governor disc on its shaft which contained the Buckeye governor. The fly-wheel was the ordinary band-wheel type and was never intended for governor.

X Q. 39. You do not mean, do you, that the fly-wheel was ever used as a band wheel on either of those engines?

A. I do. It's the common practice in New England factories to make the belt or band wheel and fly-wheel one. I can recall only one instance in our practice at Hartford of departing from that plan.

X Q. 40. Describe exactly and precisely the governor discs upon the shafts of those two Hartford Co.'s engines.

A. It was a cast-iron disc, in the neighborhood of 40 inches in diameter, with the flange on the disc's circumference, something like the rim of a pulley, projecting to one side in such a way as to cover the governor. In their later practice the dise has been abandoned and an open wheel, with arms, something like Defendants' Exhibit B, has been substituted.

X Q. 41. This flanged disc in those two carpet Co.'s engines was a solid dise, forming one side, and having the entire oper-
367 ating governing devices contained inside of the flange, were they not?

A. The disc was solid, with the exception of its being split in halves for convenience in taking off the shaft.

X Q. 42. What need was there of this provision in those Hartford Co. engines for removing this solid disc from the shaft?

A. Sometimes repairs might make it necessary to take it off, and in case the disc and eccentrics were made solid it would be necessary to remove the crank or fly-wheel from the engine in case it was found necessary to take off the discs or eccentrics. In this particular case it would have been difficult to put the discs and eccentrics in the shaft without splitting them.

X Q. 43. Were the two discs just alike, with their contained parts?

A. To the best of my recollection, they were duplicates.

X Q. 44. Could these discs be adjusted along the shaft of either of those two carpet Co. engines?

A. In a horizontal direction, yes, to the best of my recollection.

X Q. 45. How far were these discs located from the fly-wheels in those carpet Co. engines?

A. I am unable to say definitely. My recollection is that the eccentric rod, from the cut-off eccentric in the disc, passed within a few inches of the rim of the fly-wheel.

X Q. 46. The same shaft carried the disc and the fly-wheel, did it?

A. It did.

X Q. 47. What was the diameter of this shaft?

A. Approximately, ten inches.

X Q. 48. In what manner were the two valves forming this disc attached to each other and the shaft when in position in the shaft forming the disc?

368 A. They were held—the two halves were held together by bolts passing through flanges from one side to the other, and they were clamped to the shaft by these bolts.

X Q. 49. How wide, about, were the flanges respectively on these discs?

A. That I am unable to say.

X Q. 50. Give about the width.

A. Lugs or flanges 2½ inches across would be ample, and I presume these were in the neighborhood of that size.

X Q. 51. Was the open or exposed face of this disc towards or from the fly-wheel?

A. My recollection is, from the fly-wheel, facing the crank.

X Q. 52. What, approximately, was the weight of this disc?

A. In the neighborhood of 200 pounds.

X Q. 53. Of what material was it made?

A. It was cast iron.

X Q. 54. Did this disc serve any other purpose than as a housing or containing disc for the governor?

A. None whatever. Its office was simply to make a base upon which to build the governor.

X Q. 55. What was the length of the shaft which carried this disc and fly-wheel?

A. I have no idea which might be a correct one. Approximately, in the neighborhood of 10 feet.

X Q. 56. Cannot you state approximately the weight of the fly-wheel on each of those carpet Co. engine shafts?

A. My recollection of the fly-wheel is, the old wheel was retained when the engines were rebuilt. I had nothing to do with that or the rebuild- of the engines, and have only a faint recollection of the wheel.

369 X Q. 57. From your knowledge of engines, what must be the effective weight of a fly-wheel in an engine running at the speed you have indicated and of the horse power you have given as to these carpet Co. engines?

A. That could only be determined by calculation based upon a knowledge of the conditions.

X Q. 58. Do you mean to state that, with your professed knowledge of engines, you cannot state, even approximately, the neces-

sary weight of a fly-wheel to operate successfully those carpet Co. engines?

A. I mean to say that without calculation I would not attempt to do it. Guessing on fly-wheels that should give the best results is so uncertain that I do not care to do it.

X Q. 59. You will admit, will you not, that each of those fly-wheels upon those carpet Co. engines weighed at least 20,000 pounds?

A. I will admit nothing of the kind, for I have no knowledge of it.

X Q. 60. And you haven't any doubt about it, either, have you?

A. I can't answer that question; it's too indefinite.

X Q. 61. How much, about, would a fly-wheel weigh which you would load onto the shaft of a Buckeye engine of substantially the same horse power and substantially the same speed as those carpet Co. engines with the same diameter?

A. Approximately, 25,000 pounds. Calculation might change that weight materially.

X Q. 62. Would it have been possible in those two carpet Co. engines to have removed the fly-wheels entirely and run the engines with a band on this flanged disc you have described and have retained a successfully operating engine?

A. As I understand the question, you wish to know if the fly-wheel in the Hartford Carpet Co. engines could be removed
370 and the discs substituted as driving wheels with equal results. It could not. Discs of sufficient size to act as balance wheels and with sufficient width of rim to serve as driving wheels would, if properly fastened to the shaft, fill the office of fly-wheel and governor disc at the same time.

X Q. 63. The question was intended a little broader. What I wish to know is, if the fly-wheels of the Hartford Co.'s engines had been removed, could the discs then on the driving shafts have been utilized for any practical purpose as driving wheels in operating the engine?

A. They could not.

X Q. 64. In what manner were the fly-wheels fastened to the shafts of the carpet Co.'s engines?

A. I have no positive knowledge, but presume they were keyed in the ordinary way.

X Q. 65. Was the governor on the solid discs of those carpet Co.'s engines a patented governor; and, if so, whose patent?

A. I have understood they were patented and assigned to the Buckeye Engine Co. by J. W. Thompson, of Salem, Ohio.

X Q. 66. Is that the same Thompson who is now engineer of the Buckeye Engine Co.?

A. Yes, sir.

X Q. 67. Who made the dash pots that went on those carpet Co. engines at Thompsonville?

A. I can only say they were made at the machine shops of the Hartford Engineering Co.

X Q. 68. Did you ever personally see them on the carpet Co.'s engines?

A. I did not.

X Q. 69. How many times did you ever see those two engines of the Hartford Carpet Co.?

A. Twice, I am sure of; three times, I think. I saw them once before the dash pots were applied; saw the engines in mo-
371 tion after the dash pots were attached, but have no recollection of paying any attention to the dash pots.

X Q. 70. This "racing" of engines is one of the most difficult problems to handle in engine construction, is it not? I mean as to its control or elimination.

A. I don't think so.

X Q. 71. Its presence in any engine is highly undesirable, is it not?

A. It is.

X Q. 72. Is not a suitable fly-wheel absolutely essential to the successful operation of an engine for any practical purpose?

A. It is.

X Q. 73. Will you please designate the properties and functions of the fly-wheel which thus make it an essential element in engine construction?

A. Power transmitted through a crank is intermittent, owing to the variable length of the crank, due to its angularity. When the piston is at half stroke the crank is longest and most effective. As the crank moves in either direction towards the centre its angle changes, and in consequence the effect of the crank is lessened until it reaches the end of the stroke or zero; at that point the crank has no capacity to transmit power. The office of the fly-wheel is to absorb velocity, momentum, when the crank is at its greatest and most effective angle, and pay it out again when the crank is working at its least effective angle. The result of this is to give more uniform velocity through the different portions of the revolutions of the crank.

Adjourned until 1.30 p. m. to-morrow.

Met pursuant to adjournment.

Parties present as before.

X Q. 74. Can you state approximately about what number of engines the Buckeye Engine Co. have manufactured and sold per year?

A. I cannot; have no knowledge of their business.

372 X Q. 75. It has been one of the largest concerns of that kind in the country, has it not?

A. Not one of the largest. I believe they employ from 125 to 150 men.

X Q. 76. Was the containing disc carrying the governor on the Hartford Manilla Co. engines the same as on the carpet Co. engines?

A. It was not. It was an open wheel with arms, and had more the appearance of a small fly-wheel.

X Q. 77. You know perfectly well, do you not, that the disc on the Manilla Co. engine had no resemblance, function, or characteristic of any description with a fly-wheel?

A. I know that incidentally it did have the functions of a fly-wheel. It is impossible to revolve a pound of iron in any way fixed to the shaft so that it does not perform the functions of a fly-wheel in proportion to its weight and distance from the center. In calculating weights of fly-wheels all parts attached to the shaft that revolve with it, including the crank disc, should be considered. In some cases the entire fly-wheel is made up of the crank.

X Q. 78. I would suggest that your answer appears to be more of an over-night argument on an after-conceived theory, and would suggest further that you are expected to testify as to a question of fact, and to this end will again ask you if the disc attached to the shaft of the Manilla Co. engine was intended or expected in any manner or in any respect to perform the functions or meet the conditions in any manner of a fly-wheel.

A. If you had asked your former question with a better understanding of what you wanted to find out, your following question would have been less insulting. The governor wheel for the Hartford Manilla engine was not put on for the purpose of a fly-wheel, but, as I said in my former answer, incidentally it did perform that function to the extent of its weight. The wheel containing the governor was a mechanical convenience.

373 X Q. 79. How much did it weigh in the Manilla Co. engine—the disc?

A. The disc in parts, I should say, about 350 pounds; that is only approximate—only guessing.

X Q. 80. Was this disc in two parts like the carpet Co. disc before being attached to the shaft?

A. It was not a disc; it was a wheel with arms. It was in two parts, same as Hartford Carpet Co. engines.

X Q. 81. How were these two parts fastened to the shaft in the Manilla Co. engine?

A. Clamped together with bolts substantially the same as Hartford.

X Q. 82. How many times did you ever see that Manilla Co. engine?

A. I saw it nearly every day during the process of its construction and a number of times in the Manilla Co.'s works

X Q. 83. How long did it take to fix this Manilla Co.'s engine before it would run properly?

A. We built this engine in the Hartford Engineering Co.'s works.

X Q. 84. How long did it take to build the engine?

A. At that time we had a number of engines in the process of construction and this went along with them. The time from beginning to finish, I should say, was in the neighborhood of three months.

X Q. 85. How much did the fly-wheel weigh and what was its size on the Manilla Co.'s engine?

A. My impression is the diameter was 12 feet, and I would estimate the weight to be about 12,000 pounds.

X Q. 86. What was the horse power of this Manilla Co.'s engine and its normal speed?

A. I believe its rated horse power was 175 and its speed, I think, 120 revolutions per minute. The cylinder dimensions were, I think, 18 inches bore by 30-inch stroke.

X Q. 87. Did it have more than one fly-wheel?

374 A. I think only one, which served as belt wheel also.

X Q. 88. What was the diameter of the shaft carrying the fly-wheel and the governor attachment?

A. I think it was nine inches in the main bearing; it may have been enlarged for the wheel fit, but I think not.

Redirect examination:

R. D. Q. 1. At what point on the shaft of an engine is it most convenient and natural to place the governor when a shaft governor is used?

A. A shaft governor is a part of the valve gear itself and must be placed on the shaft in line with its connections. This brings it near the main bearing.

R. D. Q. 2. What do you mean by the main bearing?

A. That bearing in the engine bed next to the crank.

R. D. Q. 3. Where is the other bearing?

A. At the other end of the engine shaft; it is usually called the out-bound bearing.

R. D. Q. 4. To what class or type of engine do you now refer?

A. That class commonly known as side-crank engines.

R. D. Q 5. What is understood by the term self-contained engine as a designation of a type or class of engine?

A. A self-contained engine is what its name would imply—a machine complete in itself. Its shaft bearings are all connected to its bed, so that it requires no new alignment when put on foundation. There are two types of self-contained engines, one known as center crank, with the bearings on either side of the crank. In this case the band or fly-wheels are on the projecting ends of the shaft outside of the bearings. The other type is known as the side crank with a Y-shaped projection from the engine bed which contains the out-bound bearing. There is sufficient space in the opening

375 of this Y for band or fly-wheel. In some cases the shaft projects through the outer bearing for the purpose of carrying the second wheel.

R. D. Q. 6. In that type of engines which are called center-crank self-contained engines is it common to place the fly-wheel or band wheel in line with the valve and apply the governor within it?

A. It is.

R. D. Q. 7. In that class of engines which are known as side cranks, with an outward bearing, what is the practice as to the lo-

cation of the fly-wheel and the governor with relation to the main bearing?

A. That depends on the builder and the size of the engine. B. W. Payne & Sons, of Elmira, N. Y., put the governor in the fly-wheel or band wheel, as the case may be, in their smaller sizes of side-crank engines. In their larger sizes they use a separate containing wheel for the governor and let the fly or band wheel take any convenient place on the shaft. This is largely a question of shop convenience and economy. I believe the general practice with the Buckeye Engine Co. is to use separate wheels for the governor.

R. D. Q. 8. Is it not a fact that in all engines, whether side-crank or self-contained, which have a governor on the main shaft that both the governor and the fly-wheel, and also the belt wheel, if there is both a belt wheel and a fly-wheel, are firmly secured to the main shaft and move together around the common axis as if they were all integral?

A. Yes; they are practically one in effect.

R. D. Q. 9. If the fly-wheel of an engine is at a distance from the governor longitudinally of the shaft, is the action of the governor in any way modified or qualified from what it would be if the governor was located in the fly-wheel?

A. It is not.

376 R. D. Q. 10. Do you appear here as a professional expert in the sense of having been retained and compensated for your services or by reason of your knowledge of the prior use, to which you have testified?

A. I do not appear here as an expert having been retained and compensated, but am here because of knowledge of prior use.

HARRIS TABOR.

Sworn and subscribed before me the 8th day of May, 1888, at the city of New York.

E. R. McCARTY (No. 54),
Notary Public in and for City and County of New York.

List of Patents to Harris Tabor.

	No.	Date.
Bushing for governor and other valves	134,483	Dec. 31, 1872
Governor for engines	191,084	May 22, 1877
Governor for valve motions	206,500	July 30, 1878
Indicator	210,643	Dec. 10, 1878
Governor	276,304	Apr. 24, 1883
Shaft bearing	297,312	Apr. 22, 1884
Crank disk	297,313	Apr. 22, 1884
Cylinder head	303,070	Aug. 5, 1884
Governor	303,895	Aug. 19, 1884
Shaft coupling	322,866	July 21, 1885
Speed indicator	325,991	Sept. 8, 1885

	No.	Date.
Metal-founding machine	347,447	Aug. 17, 1886
Moulders' flask	347,448	Aug. 17, 1886
Metal-founding machine	369,214	Aug. 30, 1887
Moulding machine	365,709	June 28, 1887
Metal-founding machine	365,710	June 28, 1887
Sand-moulding machine	365,711	June 28, 1887
Speed governor	309,895	Dec. 30, 1884

377 *Deposition of E. H. Schneider.*

EDWIN H. SCHNEIDER, being called on the part of the defendant-, cautioned, and sworn, deposes as follows:

Direct examination by JOHN K. HALLOCK, Esq.:

Q. 1. What is your name, residence, and occupation?
A. Edwin H. Schneider; age, 36; Brooklyn, N. Y.; engineer.
Q. 2. In whose employ are you?
A. Employ of C. Annan.
Q. 3. At what establishment?
A. I am at the grain elevator known as Dow's stores, Brooklyn.
Q. 4. Have you charge of the engines at that elevator?
A. Engines and boilers.
Q. 5. What engines are they, and how many are there of them?
A. The Buckeye engines; there are three of them.
Q. 6. When were these engines put in at that establishment?
A. They were put in in the summer of 1880.
Q. 7. Please describe the uses of these engines.
A. Two are main engines the and third is an auxiliary for driving the air pumps.
Q. 8. By whom were you employed in 1878, 1879, and 1880?
A. I was in the employ of the Buckeye Engine Co. agency all that time.
Q. 9. What were your duties?
A. Setting up engines and occasionally repair jobs on them.
Q. 10. Had you anything to do with the setting up of the main engines at Dow's stores when they were put in?
A. Yes, I had charge of that work.
378 Q. 11. As an employé of the Buckeye Engine Co.?
A. Yes.
Q. 12. I show you Defendants' Exhibit B. Please state what it is a model of.
A. The governor of the Buckeye engine, built by the Buckeye Engine Co., of Salem, Ohio.
Q. 13. I call your attention to a tabular formed device in that model which lies parallel with one of the springs; is pivotally attached to one of the arms of the wheel; has a rod working in it, which is connected with one of the weight arms, and ask you what you understand that device to be.

A. It is known as a dash pot, and its office is to prevent any sudden, violent fluctuation of the governor.

Q. 14. Did you ever see an engine having thereon a governor like this model, with a dash pot therein, for the purposes you have named, and attached substantially as shown in said model?

A. No; none except those I applied the dash pot myself.

Q. 15. You have applied a dash pot to a steam-engine governor like the one shown in this model, substantially as it is applied here, have you?

A. With this exception, that instead of being attached to one of the movable arms it is attached to one of the lugs of the movable eccentric and the other end to one of the arms of the wheel.

Q. 16. Please designate on that model the part to which you refer as "one of the lugs."

A. Witness points out an elliptical part immediately below an eccentric disc and says: "This is it."

Q. 17. Is that part which you have first designated one of the movable parts of the governor?

A. It is.

Q. 18. When did you first make such an application of a dash pot to a governor as you have stated in your answers to questions 14 and 15, and where was that application made?

379 A. The first application was made on an engine in Syracuse, at the Syracuse iron works.

Q. 19. You mean Syracuse, N. Y.?

A. Yes, sir. I don't know the exact date, but it was previous to 1880.

Q. 20. Where did you next apply one?

A. Well, I can't answer that question, because I put several others on about the same time, but among them was on the engine of Dow's stores, known at that time as the Pacific elevator, located at Brooklyn, N. Y.

Q. 21. Those are the engines you now have charge of, are they not?

A. Yes, sir.

Q. 22. Are those dash pots still in use on those engines?

A. They are.

Q. 23. About when were they put on?

A. Some time in December, 1880.

Q. 24. It is in evidence in this case, in the testimony of J. W. Thompson, that you furnished the Buckeye Engine Co. with drawings illustrating the manner in which the dash pots were constructed and the appliances by which they were to be attached. Is that statement true?

A. It is.

Q. 25. Did you furnish such drawings in the case of the engines in the Pacific elevator, or Dow's stores, as it is now called?

A. Yes; I did.

Q. 26. Can you produce the sketch which you so furnished?

A. I can. Here it is. (Witness produces sketch.)

Q. 27. Is this the original sketch?

A. It is.

Defendants' counsel offers in evidence the drawing just referred to and produced by the witness, which is marked Defendants' Exhibit D.

380 Objected to as immaterial and irrelevant.

Q. 28. What do the figures on this drawing represent?

A. They represent what is known as a dash pot.

Q. 29. None of the parts of the governor are shown, are they?

A. No.

Q. 30. I call your attention to a date on that drawing. Was the drawing made on that date?

A. It was.

Q. 31. Did the Buckeye Engine Co. furnish you dash pots constructed in accordance with that drawing?

A. They did.

Q. 32. How soon after that date which is marked on the drawing?

A. As soon as they could construct them.

Q. 33. Did you apply those dash pots to the engines of which you now have charge?

A. I did.

Q. 34. Are they still on those engines?

A. They are.

Q. 35. When did you apply them to those engines?

A. Some time in December, 1880.

Q. 36. Are they so applied to the governors of those engines as to be in combination with the relatively movable parts of the governors?

A. They are.

Q. 37. Where are the governors located on those engines?

A. They are located on the ends of the main shaft.

Q. 38. Do those two engines have a common main shaft?

A. Each engine has its own shaft, but they are coupled so as to form a common main shaft.

Q. 39. And are those governors at the opposite ends of the main shaft?

A. They are.

381 Q. 40. Where are the fly-wheels?

A. The fly-wheels are between the inside main bearing of each engine and the centre bearing of the main shafts.

Q. 41. That would bring the fly-wheels between the two engines, would it not?

A. It would.

Q. 42. Are those fly-wheels also used as band wheels?

A. They are.

Q. 43. Are the governors and the cranks and the fly-wheels or band wheels all firmly secured to the main shaft so as to move as if an entity?

A. They are.

Objected to as grossly leading.

Cross-examination by C. K. OFFIELD, Esq.:

X Q. 1. Have you ever handled or had charge of any engines except engines made by the Buckeye Engine Co. of Salem, Ohio?

A. I have not.

X Q. 2. How long have you lived in Brooklyn, N. Y., and had charge of the Buckeye agency?

A. I have lived in Brooklyn eight years; never had charge of the Buckeye agency; simply an employé.

X Q. 3. When was this engine put in the Syracuse iron works, at Syracuse, N. Y., by the Buckeye Engine Co.?

A. The engine at Syracuse was a rebuilt job, on an old engine, and was rebuilt some time previous to 1880; think it was the winter of '79 and '80.

X Q. 4. Who rebuilt it?

A. The plans were furnished by Mr. Church and Mr. Thompson.

X Q. 5. Did the Buckeye Co. rebuild it?

A. Yes.

X Q. 6. You put the dash pot in that Syracuse engine because it was defective and wouldn't run satisfactorily, did you?

382 A. Yes, sir.

X Q. 7. Where was the governor located on the engine of the Syracuse iron works and on the engine of Dow's stores?

A. They were both on substantially the main shaft.

X Q. 8. On what part of the shaft?

A. On the ends.

X Q. 9. How were these governors attached to the shafts on the Syracuse and Brooklyn engines, as I shall call them hereafter when referring to the Syracuse iron works and Dow's stores?

A. In the Brooklyn case they were clamped in; in the Syracuse case, I think the same method, but I don't remember.

X Q. 10. What do you mean by clamping on the governors in the Syracuse and Brooklyn engines? Describe exactly the operation and means employed.

A. The hub is divided into two parts or two halves, and those two halves, when on the shaft, are drawn together by bolts of sufficient force to hold them fast to the shaft.

X Q. 11. And these hubs on the Syracuse and Brooklyn engines contained the governors in which you put the dash pots?

A. The hub is only one part of the wheel which contains the governor.

X Q. 12. Well, what do you mean by that?

A. Well, every wheel has a hub, which is the central portion of it, and has the hole which the shaft goes through.

X Q. 13. What else was there in connection with this hub and the governor in the Syracuse and Brooklyn engines?

A. A system of movable arms, weights, springs, and their connecting parts.

X Q. 14. The Buckeye Engine Co. put the governors on to

383 the hubs and shafts of these Syracuse and Brooklyn engines when they first put them up, didn't they?

A. They put the governors on to the shafts; the hubs are part of the governor.

X Q. 15. What protected and sustained these governors and their connecting devices on these Syracuse and Brooklyn engines?

A. A wheel or case known as the governor wheel.

X Q. 16. Was this case made in two parts in the Brooklyn and Syracuse engines?

A. In the Brooklyn engine it is, and I think the same construction in the Syracuse engine.

X Q. 17. How large was this containing case for the Buckeye engines on the Syracuse and Brooklyn engines?

A. Don't know the exact size; somewhere between four or five feet in diameter.

X Q. 18. How much do they weigh apiece?

A. That I couldn't tell.

X Q. 19. Give your best judgment.

A. Well, probably in the neighborhood of 500 pounds.

X Q. 20. Do these cases on these two engines serve any other purpose except as a case for the governor?

A. They do not.

X Q. 21. Can these cases be moved along upon the shaft to which they are attached?

A. They can when made loose on the shaft—when loosened up and the bolts unscrewed.

X Q. 22. How far are these governor cases located from the fly-wheel on the shaft?

A. Probably six to eight feet.

X Q. 23. What horse-power are the Syracuse and Brooklyn engines respectively, and what is their speed?

384 A. The Syracuse engine, I believe, is about 300-horse power. The Brooklyn engines are 600-horse power each.

X Q. 24. What is the size and approximate weight of the fly-wheel on these engines respectively?

A. I don't know anything about the Syracuse engine as to size and weight, but the Brooklyn engines have two fly-wheels apiece; each fly-wheel is 18 feet in diameter and weighs about eight tons, making 32 tons for the two engines. The speed of the Syracuse engine was about 50 revolutions per minute when I left it. The speed of the Brooklyn engines is 85 revolutions per minute.

X Q. 25. You mean 2,000 pounds for a ton, do you?

A. Yes, sir.

X Q. 26. The dash-pot device that you put in the governor case of the Brooklyn engine was put in for the purpose of attempting to remedy a defect in the operation of the engines, was it not?

A. Yes.

X Q. 27. Were they entirely satisfactory as to results in the Syracuse and Brooklyn engines?

A. They were.

X Q. 28. Perfectly confident of that, are you?

A. As far as I know from my own personal observations.

X Q. 29. For what purposes are these Syracuse and Brooklyn engines used?

A. The Syracuse engine was driving a train of rolls at the time I left it—a rolling mill for rolling iron. The Brooklyn engines drive the machinery of a grain elevator.

X Q. 30. The principal object in putting the dash-pot devices in the governor cases of the Syracuse and Brooklyn engines was to prevent the engines from injuring themselves, was it not?

A. It was.

385 X Q. 31. Has that governor case either on the Syracuse or the Brooklyn engines been renewed, altered, or changed since you fixed it?

A. The Brooklyn engine has not; the Syracuse engine I couldn't say.

X Q. 32. Have you given your deposition as to dates from your recollection as to the additions made to the governor case upon those engines?

A. Yes.

X Q. 33. Would either the Syracuse or Brooklyn engine be operative for any practical purpose if you should remove the fly-wheels and attempt to utilize the governor case for driving purposes with a belt?

A. No, sir.

X Q. 34. Did you make this sketch offered in evidence yourself?

A. I did.

X Q. 35. Who made the dash pots that went in the Syracuse and Brooklyn engines governor cases?

A. The dash pots on the Syracuse engine were made at the Syracuse iron works by one of their employés under my supervision. The dash pots on the Brooklyn engine were made by the Buckeye Engine Co., at Salem, Ohio.

Redirect examination by Mr. HALLOCK:

R. D. Q. 1. What do you understand by the term "fly-wheel governor"?

Objected to as incompetent.

A. I don't understand anything. I have always known them as shaft governors.

R. D. Q. 2. Supposing the wheel which contains the governor on one of the Buckeye engines of which you have charge was enlarged in diameter and made sufficiently heavy to serve as a fly-wheel or sufficiently wide on its face to serve as a belt wheel, would that in any way change or affect the operation of the governor

386 or add to or detract from or qualify the functions performed by the dash pots in that governor?

Objected to as leading in every respect, and for the further reason that it does not appear from the deposition of this witness that he would know what would be the effect of the supposed construction.

A. It would not.

R. D. Q. 3. If the governor case was thus enlarged, would there then be any necessity of any other fly-wheel?

A. There would not.

EDWIN H. SCHNEIDER.

Subscribed and sworn to before me, a notary public in and for the county of New York, in the State of New York, this 7th day of May, 1888.

CHAS. E. HITCHCOCK,
Notary Public (197), *New York County.*

Deposition of F. H. Ball.

F. H. BALL, being duly called, cautioned, and sworn, deposes as follows:

Q. 1. Are you a member of the Ball Engine Co., the defendants in this case?

A. I am.

Q. 2. Are you the F. H. Ball named in the patent, Defendants' Exhibit C?

A. I am.

Q. 3. What class or type of engines have the Ball Engine Co. heretofore manufactured? I mean with relation to their being side-crank or self-contained?

A. We have manufactured what are known as self-contained engines only, and no others.

387 Q. 4. In the engines made by the Ball Engine Co. what wheels are there on the main shaft?

A. Two wheels. One we call a balance wheel and one a driving wheel.

Q. 5. Is a balance wheel a fly-wheel?

A. It is. It goes by both names.

Q. 6. Did the Ball Engine Co. ever make an engine with the shaft governor in the fly-wheel?

A. They have not.

Cross-examination by C. K. OFFIELD, Esq.:

X Q. 1. Did you, both as an individual and an officer of the defendant corporation, authorize the construction of engines having in them, as a part of their structure, the organization or device represented by the Complainant's Exhibit Defendants' Fly-wheel Governor between the months of July, 1884, and the date of the filing of the bill of complaint herein?

A. I did.

X Q. 2. And you have personally been actively engaged in conducting the defence in this suit, have you?

A. I have.

X Q. 3. What is the weight of the fly-wheel in the engines of the

defendants, represented by Complainant's Exhibit Defendants' Fly-wheel Governor?

A. The weight of the wheels depends on their size. If you will ask me about any particular size wheel I will give you an approximate weight.

X Q. 4. Give the weight of the smallest wheel and of the largest wheel and the average intermediate wheel, like Complainant's Exhibit Fly-wheel Governor made by the defendants.

Defendants' counsel asks that the counsel for complainant state what he means "by the different-sized wheels." Does he mean the size of wheels for different-sized engines? And also defendants' counsel objects to the comparison in the latter part of the question, for the reason that the wheel shown in the exhibit is not a fly-wheel, strictly so called, but a belt wheel.

388 A. I should say that the various sized wheels employed or used on the engines referred to would range in weight from 300 pounds to 2,000 pounds.

X Q. 5. On what power of engine, and what speed?

A. Not being asked in regard to any special size, I included the wheels used on engines from 20-horse power to 100-horse power, running at speed varying from 250 to 350 revolutions per minute.

X Q. 6. Have you more than two wheels on the shaft of any of your engines?

A. It is our regular practice to use two wheels only.

X Q. 7. In a 20-horse-power engine of yours what is the weight respectively of these two wheels?

A. Generally they are both the same weight and size, their weight depending on the size. I might state further that the weight of the wheels is also determined by the speed at which they are to be run. The smallest wheels used on these engines weigh about 300 pounds and the largest about 1,000 pounds. The weight of these wheels is intended for the standard speed of the engines. When run at a slower speed additional weight is put in the wheels, and generally, when the smaller sizes are used for driving wheels, a larger and heavier balance wheel is employed, unless the speed is high enough to make it unnecessary.

X Q. 8. Your engines are made largely for the purpose of operating electric-light plants, are they not?

A. They are.

X Q. 9. What is the diameter of each of your wheels on your 100-horse-power engine, running at ordinary speed?

A. The regular sizes used are 48 inches, 54 in., 60 in., and 66 in. in diameter. Occasionally larger or smaller wheels have been used.

X Q. 10. Are the two wheels used by you on the same engine exactly alike before the governor and dash-pot devices are associated with one of them?

389 A. Sometimes they are and sometimes they are not. The question as to the relative size of the wheels on each engine is settled by the requirements of the purchaser of the engine.

X Q. 11. What is the weight of the governor and dash-pot devices, together with their necessary attachments, which you place on one of the wheels of your engines—say in your 100 horse power engine and in your 50 horse power engine, running at ordinary speed?

A. I cannot say exactly, but should think the weight of the details of the governor which we place in the wheel of our engines would be about as follows: In the 100 horse power engine from 150 to 200 pounds, and in the 50 horse power engine from 100 to 150 pounds.

X Q. 12. In any of your engines would the removal of either wheel leave the engine a practically operative and successful machine?

A. That would depend on the size of the remaining wheel, or rather its weight, and the speed at which the engine was being run.

X Q. 13. Perhaps; but you have just testified that the wheels were generally of the same weight on the same engine. Now, can you remove either of these wheels and leave a practically operative engine?

A. In many cases I think it might be done.

X Q. 14. The reason that it can be done is because both wheels are fly-wheels or balance wheels, is it not?

A. Undoubtedly both wheels and everything which is attached to the shaft and revolves with it acts as balance wheel to carry the engine by its centres. The combined weight of this revolving mass must be sufficient to ensure a reasonably uniform rate of rotation of the shaft. If this amount of weight is found in the driving wheel containing the governor, no further balance wheel is required. If not, it must be used.

X Q. 15. Prior to 1884 you, the defendants, had on their
390 engines a balance wheel of large size and a pulley wheel of small size in which you located a governor without any dash pot, didn't you?

A. We did.

X Q. 16. At what time did you change from the construction just described to the construction you now use, represented by Complainant's Exhibit Defendants' Fly-wheel Governor?

A. About a year and a half ago, or in the fall of 1886.

X Q. 17. Prior to a year and a half ago, when you adopted your present form of construction, you designated the wheel on your shaft that didn't carry a governor or dash pot as a fly wheel, didn't you?

A. Yes, sir; a fly-wheel or balance wheel, both terms being used.

X Q. 18. Do you use the same size and weight of fly-wheel now on your engines that you did prior to a year and a half ago?

A. In many cases we do, as they are made from the same patterns.

X Q. 19. Now, isn't this the entire fact: that for the last year and a half you have discarded the pulley wheel, with its contained governor and without a dash pot, and have substituted therefor a fly-wheel or a balance wheel of the same size as the fly-wheel already

upon the engine and have placed in this wheel a governor and a dash pot, as shown by Complainant's Exhibit Defendants' Fly-wheel Governor?

A. We have not discarded any wheels, but use the same patterns formerly employed in most cases. In deciding as to the weight of wheels, it is our practice now, as formerly, to take into consideration the aggregate weight of both wheels and all the parts which revolve with them. If, from the necessity of the case, a driving wheel of small size and light weight is employed, a larger or heavier wheel is put on for a balance wheel. As a matter of fact, in electric
391 lighting, where, generally, wheels of large sizes are used, the requirements as to strength necessitate the use of wheels having ample weight and more than is necessary to insure reasonably uniform rate of rotation. Therefore it is not generally a question as to the weight required for balance-wheel purposes, as there is, from necessity, a superabundance.

X Q. 20. Is that the best and fairest answer you can make to that question?

A. After looking over your question again, I might add that the change in the construction of our governor to which you refer had nothing whatever to do with the size of driving wheel employed on the engine. Formerly, as now, the size of this wheel was determined by the requirements of the purchaser. All the sizes of driving wheels now used on our engines were used with the former construction of governor to which you refer.

X Q. 21. How long has it been since you—and when I say "you" I mean the defendants—have made an engine with a pulley wheel such as you made before you adopted your present construction? Please answer the question without talking about something else.

Counsel for the defendants objects to the last clause of the question as impertinent, the witness in the former answers not having talked about anything not enquired about.

A. If the counsel will please ask the question in a little more definite and intelligent manner I will endeavor to answer briefly. I do not understand when you say "pulley" whether you mean governor or what.

X Q. 22. That's curious. In answer to cross-question 15 you swore flat-footed that prior to 1884 you used a balance wheel of large size and a pull-y wheel of small size, in which you located a governor without any dash pot, and now I ask you how long it has been since you made an engine with this small-size pulley wheel and you don't appear to know what's wanted. Can't you answer the question?

392 A. We make engines with small governor pulleys now as formerly. If you wish to know how long since we put in these governor pulleys, the details of the governor without a dash pot, I should say, from recollection, that it was between two and three years. By way of further explanation, if the counsel will allow me to explain, I will say that we have used dash pots in a foamer construction of governor details used prior to the present

construction, which I have already said we have been using for about a year and a half.

X Q. 23. Your catalogues issued each year show the kind of engines you have manufactured, do they not?

A. We have never issued but one regular catalogue, and that was intended to illustrate our engine as clearly as possible at the time of the publication of the catalogue.

X Q. 24. What year was that catalogue issued?

A. I do not remember, but think 1883 or 1884.

X Q. 25. Have you not distributed circulars illustrating your engines as made during the last year and a half?

A. Not in the nature of a catalogue.

X Q. 26. Give the names of some of the parties in Chicago who have purchased and who are now using your engine constructed like Complainant's Exhibit Defendants' Fly-wheel Governor?

A. Two engines with governors like the exhibit referred to are in use in the Union passenger station of the Penna. Co. at Chicago, and, I think, several others, whose names I cannot now recall.

X Q. 27. When did you first see an engine of the complainant Ide with the devices like the patent in suit?

A. I cannot remember.

X Q. 28. I will refresh your recollection. It was at an ex-
393 position at the city of St. Louis, where you and Mr. Ide had your engines on exhibition in the year 1885, was it not?

A. I saw one of the complainant's engines at the exposition, to which you refer, and may have seen one previous to that time; presume I had.

X Q. 29. You stated in conversation to Mr. Ide at that time that you had never before seen or heard of an engine having a fly-wheel or driving wheel combined with a governor and dash pot, did you not?

Defendants' counsel states that he has no objection whatever to the witness answering the question, but it is manifestly improper, not being cross-examination; and, further, as the counsel in framing the question made reference to a document in his possession and consulted the complainant, who is now present, defendants' counsel asks to see that document before the witness answers.

Complainant's counsel most respectfully declines to exhibit any documents to defendants' counsel and requests the witness to answer the question.

Defendants' counsel assumes that the document in the hands of complainant's counsel is an affidavit sworn to by Mr. Ide and intended for use in a preliminary action in the case brought by complainant against defendants at Springfield, Ill., which, for reasons only known to complainant, they refused to show or file at that hearing, and as complainant has not been put upon the stand defendants' counsel objects to any question founded on matter in that affidavit, but he leaves the witness free to answer, subject to the objection.

A. I do not remember any conversation with Mr. Ide on any subject whatever at the time or place referred to.

394 X Q. 30. Do you remember whether this St. Louis exposition was in 1884 or '85, and did you ever compete with the Ide engine at the St. Louis exposition more than one time?

A. I cannot say definitely as to the date of the exposition and must ask the counsel to say what he means by my competing with the Ide engine. We had an engine in operation at the exposition, which engine was in charge of our St. Louis agents. Do you refer to any competition between this engine and the Ide engine?

X Q. 31. I do, at that exposition.

A. I was only there a few days, soon after the opening of the exposition, and have no knowledge of any competition between the engines except in a published report recently made by Mr. Ide.

Adjourned until Wednesday, May 9, 1888, at 10 a. m., same place.

MAY 9TH, 1888.

Met pursuant to adjournment.

Redirect examination by Mr. HALLOCK:

R. D. Q. 1. Mr. Ball, have you a copy of one of your catalogues here?

A. I have; here it is (producing catalogue).

Defendants' counsel introduces the catalogue in evidence as an exhibit. The same is marked Defendants' Exhibit E.

R. D. Q. 2. Is the cut on the front of the cover a picture of the engines made by defendant-?

A. It is. It represents the engine as made by my company prior to a year and a half ago.

R. D. Q. 3. Please state which of the wheels in that cut is the fly-wheel and which is the belt wheel; and also state in which wheel the governor is located.

A. The wheel on the left or rear side of the figure, or the larger wheel, we call the fly-wheel or balance wheel. The wheel on the right, or the smaller wheel in the cut, we call the driving

395 wheel, which is the belt wheel, and in this wheel the governor is located on the engine, as illustrated in the cut.

R. D. Q. 4. Is the governor, which is partially seen in that cut, the same as you make it now?

A. No, it is not.

R. D. Q. 5. In what manner does the governor differ?

A. I answer merely in regard to some of the details of its construction, its location being now, as formerly, in the wheel of the engine. The construction we now use is the same as illustrated in patent issued to me and marked Exhibit C. The construction formerly used was in accordance with a previous patent.

R. D. Q. 6. When you adopted the construction of governor shown in Defendants' Exhibit C, I understand you to have said in your cross-examination that you made no change as to its location,

and that you use the same patterns for the fly-wheel and the band wheel which you used before you made that change. Am I right?

A. You are.

R. D. Q. 7. Is it not a fact that as your engines are now constructed both wheels are often used as band wheels?

A. It is.

R. D. Q. 8. When is that generally done?

A. Generally when it is desired to have the engine drive more than one machine, as in the case of driving two dynamos from the same engine.

R. D. Q. 9. When both of these wheels are used as driving wheels what part serves the purpose of a fly-wheel?

A. Both wheels and all the parts attached to the shaft and revolving with it.

R. D. Q. 10. By what term would you designate an engine
396 governor of the type shown in your patent, Defendants' Exhibit C, and the governor shown in the patent in suit?

A. I should call them both shaft governors.

R. D. Q. 11. Is not that type of governor also designated by mechanics as "shifting eccentric governor;" also as "wheel governor"?

A. Both of the terms I have heard used and I have understood that the former is chiefly used by the Patent Office Department. I think the most common term used by designers and builders of these engines is "shaft governor."

R. D. Q. 12. Can you name a few leading manufacturers of steam-engines who, prior to July 11, 1883, manufactured steam-engines of the general style and appearance of defendants' engine and complainant's engine which had wheels, on the main shaft a governor, and at opposite ends of said shaft?

Objected to as incompetent and irrelevant.

A. Prior to the date named engines belonging to the same class as defendants' engine and having shaft governors with wheels, as described, were made by the Armington & Simms Co., of Providence, R. I.; also by B. W. Payne & Sons, then of Corning, N. Y.; also by the New York Safety Steam Power Co., of New York city, and others whose names I do not now recall.

R. D. Q. 13. So far as you know, what has been the practice, prior to July 11, 1883, among builders of that type of engine as to the place of location of the governor on the main shaft?

A. Their practice was then, as now, to put the governor in the wheel, which was located on the side of the engine where the valve and valve gear were located. Sometimes this was on one side and sometimes the other, owing to the location where the engine was to be used, which would make it sometimes more convenient and accessible from one side and sometimes from the other.

397 R. D. Q. 14. In electing or choosing which wheel shall contain the governor, is it necessary to consider the functions of that wheel as to whether it is a drive-wheel or a fly-wheel?

A. Not in the least. It is selected entirely with a view to its location in regard to the valve and valve gear. Sometimes, where

wheels of different size and weight are used on these engines, I have seen the governor located in the larger and heavier wheel and the one which naturally would be called the "fly-wheel" by reason of its greater weight. This arrangement of wheels is very common and was so prior to 1883. The reason for this arrangement is that the dynamos to be driven from the engine happen to be so placed, either by accident or necessity, with relation to the wheels from which they were to be driven so that the dynamo requiring the largest wheel was on the side of the engine where the governor and valve gear were located. With this arrangement the smaller and lighter wheel would be designated the "fly-wheel" or "balance-wheel," as a convenient method of distinguishing it from the governor wheel.

R. D. Q. 15. Can you give an instance of any builder of this type of engine prior to 1883 who placed the governor in the fly-wheel or balance-wheel?

Objected to as incompetent and irrelevant under the pleadings. Defendants' attorney states that the object of the question is to show the existing state of the art at the time of the alleged invention and not to anticipate the invention claimed in the patent, and that the question is therefore regular.

A. I cannot now from my memory give the present location of engines so arranged, but know that I have seen many arranged in this manner. I also know that the defendants have built engines prior to the date named with this arrangement of wheels.

398 R. D. Q. 16. In the specifications of the patent in suit, beginning on page 1, column 1, line 12, is the following statement: "This invention relates to that class of steam-engine governors known as 'fly-wheel governors.'" Is there any such thing known in steam engineering as a "fly-wheel governor" in contradistinction to a "shaft governor," a "wheel governor," or a "shifting eccentric governor," so that a person using the term "fly-wheel governor" would convey any other or different idea to a steam engineer than he would if he used the term "shaft governor" or the term "shifting eccentric governor" or the term "wheel governor"?

Objected to as leading and incompetent.

A. I have never heard any. The terms are synonymous. I think that the term "shaft governor" is most commonly used, but the others are also used as referring to the same arrangement.

R. D. Q. 17. When you hear the term "fly-wheel governor" used what idea does it convey to your mind?

A. The governor located on the main shaft of an engine and connected with the rest of the valve gear.

R. D. Q. 18. Were you present at Chicago at the time of taking the complainant's *prima facie* case, to wit, on the 16th day of January, 1888?

A. I was.

R. D. Q. 19. Were you present when it was stipulated and agreed

on the part of defendants' counsel that between the date of the issuing of the letters patent in suit, No. 301,720, of the date of July 8, 1884, and the date of filing the bill of complaint herein the defendants manufactured fly-wheel governors like Complainant's Exhibit Defendants' Fly-wheel Governor, and embodied the same as part of their engine construction and used the same between the dates aforesaid within the northern district of Illinois, and, if you were present, was that stipulation made with your knowledge and consent?

A. I believe it was. I was present and it was made with my knowledge and consent.

399 R. D. Q. 20. What did you understand that admission to mean and what do you now understand it to mean?

Objected to as immaterial and an attempt to escape the now apparent effect to the defendants of his admission.

Counsel for defendants denies that it is an attempt to escape any admission made by defendants as such admission would be interpreted by any one familiar with the art, but counsel admits that the testimony is for the purpose of showing what was understood by the defendant- when the admission was made and what they now understand it to mean.

A. I then understood it, as now, to be an admission that the defendants had manufactured and sold during the period mentioned a governor like the one represented by model marked "Complainant's Exhibit Defendants' Fly-wheel Governor." The term "fly-wheel governor" I then understood, as now, to be one of several terms commonly employed to designate the same device.

R. D. Q. 21. I hand you a circular. Please state what it is.

A. It is what the defendants call a list of the users of their engines, and used for the purpose of a circular. The illustration or wood cut of an engine here shown represents the engine built by the defendants with the governor details as now constructed by them and as they have constructed it for the last year and a half.

Defendants' counsel offers the circular in evidence as an exhibit and the same is marked Defendants' Exhibit F.

FRANK H. BALL.

Sworn and subscribed to before me this 9th day of May, 1888, at the city of New York.

E. R. McCARTY,

(*No.* 54), *Notary Public in and for City and County — New York.*

400 *Deposition of William Steele.*

Deposition taken by agreement, at the town of Enfield, in the county of Hartford and State of Connecticut, this 10th day of May, A. D. 1888, at 12 o'clock m., before me, Willis Gowdy, notary public within and for said town and county.

Present: C. K. Offield, Esq., on the part of complainants, and J. K. Hallock, Esq., on the part of the defendants.

And thereupon the following proceedings were had before me per agreement:

WILLIAM STEELE, a witness produced on behalf of the respondent, being duly cautioned and sworn to testify to the truth, the whole truth, and nothing but the truth in said cause, deposes as follows in answer to interrogatories propounded to him by JNO. K. HALLOCK, Esq.:

Q. 1. Please state your name, age, residence, and occupation.

A. William Steele; I will be 53 years old the 13th day of November next; Enfield is my place of residence; machinist by occupation and chief engineer of the Hartford Carpet Co.

Q. 2. In 1881 what was your occupation?

A. The same as now—in the employ of the Hartford Carpet Co.

Q. 3. I show you Defendants' Exhibit B. Please state what you understand that model to represent.

A. The Buckeye engine governor.

Q. 4. Are you familiar with that type of governor, and have you ever had charge of an engine having it on?

A. Yes; such governors are on two of the engines of the Hartford Carpet Co.

Q. 5. Do you know of the application of a dash pot within the parts of a Buckeye engine governor?

401 A. Yes; the two engines referred to have dash pots in them.

Q. 6. Do you know when the dash pots were applied to those governors?

A. In one case I can fix the date; I couldn't in both.

Q. 7. What was the date in the one you can fix?

A. July 2d, 1881.

Q. 8. How do you fix that date?

A. I fix the date from the fact that we received the news of President Garfield being shot when we were at work on them.

Q. 9. Were those dash pots applied under your direction or supervision?

A. They were.

Q. 10. For what purpose were those dash pots applied to those engines?

A. To steady the action of the governor.

Q. 11. How were they applied?

A. They were interposed between the fixed and the movable parts of the governor.

Q. 12. Have the governors to which those dash pots were applied in 1881 been constantly in use since and performed their work satisfactorily?

A. Yes; they have.

Q. 13. What do you understand to be meant by the term "fly-wheel governor?"

A. I understand it to mean any governor attached to the crank shaft of an engine. They are commonly called "shaft governors."

Q. 14. The large pair of engines which we have just seen in the mill, having a common shaft with a fly-wheel intermediate between the two engines and governors on each side of said fly-wheel, I understand to be the ones to which you were applying the dash pots on the day you heard of Garfield being shot. Am I correct?

402 A. Yes, sir.

Q. 15. In those engines the two governor frames are secured to the shaft by large bolts which pass through between the arms of the fly-wheel and bind the two discs or frames together, the fly-wheel being between the two frames or discs?

A. Yes.

Q. 16. The two discs or governor frames are about within vertical lines drawn across the rim of the fly-wheel, are they not?

A. Yes.

Q. 17. Those governors, then, are both within the fly-wheel of those engines, are they not?

Objected to as leading.

A. Partly.

Cross-examination by C. K. OFFIELD, Esq.:

X Q. 1. This dash pot, in July, 1881, was put in that governor disc by yourself, was it not?

A. Yes; and I made it.

X Q. 2. These discs in which the governor and dash pot are in, in that 1881 engine, are solid discs—I mean they are practically dishes, with the governor and dash-pot devices set in them and protected by them?

A. Practically; yes.

X Q. 3. These governor discs are entirely separate and independent on the shaft in every respect from the fly-wheel, are they not, on the 1881 engine?

A. Yes.

X Q. 4. Were these dash pots put in by you on those governor discs of your own conception to remedy a defective or unsatisfactory operation of the engine in 1881?

A. I arranged the details of it and it was put on to remedy irregular running.

X Q. 5. How much, about, does the fly-wheel on the shaft of that 1881 engine weigh?

403 A. I can give you an approximate answer—7 tons; what is known as a "7-ton wheel." It might be what they call an "8-ton wheel." Its diameter is 16 feet.

X Q. 6. About how much would this governor-containing disc weigh on the 1881 engine?

A. I can't tell how much it weighs. I should say, approximately, the two governors, the whole mechanism, would weigh 1,500 lbs. I may not be within 500 lbs. of it.

X Q. 7. That dash pot on the open governor wheel on the other engine was put on within the last 3 or 4 years, was it not?

A. I couldn't fix the date of that.

X Q. 8. It was put on, was it not, several years after the 1881 dash pot was put on, was it not?

A. Yes; and for the same reason that the other was put on.

X Q. 9. Mr. Steele, if the 7 or 8 ton fly-wheel was removed from the 1881 engine, that engine would not operate practically or successfully for five minutes or at all, would it?

A. Not at all; it would turn over.

X Q. 10. Both of these engines were Buckeye Engine Co.'s engines, were they not?

A. Not the entire engines; both of them were rebuilt, of the 1881 engines.

X Q. 11. You have intended only to answer, have you not, that a governor attached directly to a shaft by means of a disc, as shown upon your engines, is called and known as a "shaft governor"?

A. Yes; I understand that any governor on a shaft is a shaft governor that is attached to a crank shaft of an engine.

404 X Q. 12. Did you ever know of a dash pot in a governor disc until you put that one on for the purposes stated in 1881?

A. I never saw one up to that time.

WILLIAM STEELE.

Subscribed and sworn to before me this 10th day of May, A. D. 1888.

WILLIS GOWDY,
Notary Public.

Deposition taken by agreement, at the city of Providence, county of Providence, and State of Rhode Island, this 10th day of May, 1888, at 8 p. m., before me, Sam'l A. Nightingale, notary public within and for said town and county.

Present: C. K. Offield, Esq., on the part of complainants, and J. K. Hallock, Esq., on the part of defendants.

And thereupon the following proceedings were had before me per agreement:

GARDINER C. SIMMS, a witness produced on behalf of the respondent, being duly cautioned and sworn to testify to the truth, the whole truth, and nothing but the truth in said cause, deposes as

follows in answer to interrogatories propounded to him by JNO. K. HALLOCK, Esq.:

Q. 1. Please state your name, age, residence, and occupation.

A. Gardiner C. Sims; 43d year; residence, Providence, R. I.; engaged in the manufacture of steam-engines as a member of the Armington Engine Co.

Q. 2. How long have you been engaged in mechanical pursuits?

A. Twenty-five years.

Q. 3. Will you please state a history of your employment in such pursuits?

A. I served a full and regular apprenticeship of 4 years to the machinist's trade at the locomotive works of the N. Y. C.
405 R. R., West Albany, New York. I then went to the engineer department of the Brooklyn navy yard and remained three years as mechanical draughtsman, returning to the locomotive works at West Albany and remaining three years as mechanical draughtsman, one year of which I was chief draughtsman of the department. In 1872 I accepted the position of chief draughtsman in the steam-engine works of the J. C. Hoadley Engine Co., Lawrence, Mass. I then became superintendent of the works and continued in that position until the failure of the Hoadley Co., in 1877. I then engaged in business with Parden Armington, formerly general manager of the J. C. Hoadley Co. Our partnership continued until 1883, when a stock company which bears our names, Armington & Simms, was formed and is still in existence.

Q. 4. Are you a member of any technical society; if so, what?

A. I am; American Society of Mechanical Engineers.

Q. 5. I show you a Patent Office copy of the patent in suit, No. 301,720, and ask you to look at Fig. 1 and state what type of governor, of steam-engine governor, you understand to be represented in that cut.

Objected to as immaterial.

A. I should call it an automatic pulley, balance-wheel, or shaft governor or regulator.

Q. 6. When did you first see a governor of that type, and where, and who made it?

Objected to by complainant's counsel as incompetent under the pleadings of this case, for the reason that neither the name of this witness nor any indication nor suggestion of the subject-matter of any answer he may give was set up or disclosed in any way by the answer or any pleading or notice.

406 Defendants' counsel responds by saying that the question does not imply that the answer or any following matter will be in the nature of proof of prior use of the invention claimed in the patent. Counsel, however, states that the witness is not produced for the purpose of proving a prior use of the invention claimed in the patent, and therefore it is not necessary that notice of this testimony should have been given in the answer. The object of the

testimony will be to show the state of the art as it existed at the date of the application for the patent in suit.

A. 1873; in the city of Lawrence, Mass.; made at the engine works of the J. C. Hoadley Co.

Q. 7. Who designed that governor?

A. John C. Hoadley, Ruben Huntoon, and myself.

Q. 8. Who were the first parties to introduce into this country governors of the type you have named in your previous answer?

A. As I understand it, the J. C. Hoadley Co.

Q. 9. I call your attention to the following wording in the specication of the patent in suit, beginning on line 12, page 1, column 1: "This invention relates to that class of steam-engine governors known as 'fly-wheel governors.'" Please state what you understand the term "fly-wheel governor" to mean.

A. A governor placed in the fly-wheel or driving pulley of the engine in combination with the shaft.

Q. 10. Please state what you understand by the term "shaft governor" or "wheel governor," or "shifting eccentric governor," in contradistinction to the meaning that is conveyed to you by the term "fly-wheel governor."

A. Generally speaking with my associates, from my experience as a mechanic, I understand them all to be about the same.

407 Q. 11. If you were shown a drawing like Fig. 1 of the patent in suit, without any descriptive matter thereon, would you be able to say whether it was a shaft governor or a fly-wheel governor?

A. I would not.

Q. 12. Supposing that that figure represents a shaft governor, what would be necessary—that is to say, what mechanical changes would be required—to make it a fly-wheel governor?

A. If it was strictly a shaft governor and used for no other purpose, a plate pulley with rim or ordinary thin-rimmed pulley with heavy arms would be required. If used as a fly-wheel governor the wheel should be proportioned to take the power of the engine, using the spokes of the wheel for the same purpose as used in the shaft governor.

Q. 13. Would the governing mechanism perform any other or different function or produce any other or different result if it was a fly-wheel governor from what it would if it was a shaft governor?

A. It would not.

Complainant's counsel requests the notary to complete the answer by stating what the witness said to Mr. Ball, namely, "Of course, he assumes that the fly-wheel was on there."

Q. 14. Please state what you mean by my "assuming that the fly-wheel was on there." Do you mean on the shaft when a shaft governor is used? If so, I did assume that.

A. In answer to your question 13, I intended to convey that it would make no difference if the engine was properly constructed.

Q. 15. And to be properly constructed it should have a fly-wheel or its equivalent at some point in the shaft, should it not?

A. Yes, sir.

Q. 16. I will state the same question in effect in another
408 form: Is the governing mechanism of an automatic cut-off governor which is placed on the shaft of an engine in anywise modified or qualified in its action when placed in the fly-wheel from what it is when placed at any other point on the shaft more or less remote from the fly-wheel?

A. No, it is not.

Q. 17. I call your attention to the patent in suit again and ask you to observe the dash-pot mechanism therein described and state whether you understand it, its construction and described purpose or office.

A. I think I do.

Q. 18. Would the action of that dash pot be changed if that wheel shown in Fig. 1 was a fly-wheel from what it would if that wheel was a mere support or base or frame holding the governor parts?

A. It would not.

GARDINER C. SIMS.

Subscribed and sworn to before me this 10th day of May, A. D. 1888.

SAM'L A. NIGHTINGALE,
Notary Public in and for the State of Rhode Island.

And now, to wit, May 10, 1888, the defendants rest.

JNO. K. HALLOCK,
Defendants' Solicitor.

409 DEFENDANTS' EXHIBIT A.

410 DEFENDANTS' EXHIBIT C.

415 UNITED STATES PATENT OFFICE.

FRANK H. BALL, of Erie, Pennsylvania.

Engine-Governing Device.

Specification forming part of Letters Patent No. 358,829, dated March 8, 1887. Application filed May 29, 1886. Serial No. 203,651. (No model.)

To all whom it may concern:

Be it known that I, Frank H. Ball, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful improvements in steam-engine governing devices; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to steam-engine governing devices; and it consists in certain improvements in the construction thereof, as will be hereinafter fully described, and pointed out in the claims.

My invention is applicable to any of the many types of steam-engine governing devices; and in the accompanying drawings I have illustrated it as applied to the following leading types, viz: On Sheet 1 it is shown applied to the common wheel or shifting eccentric governor. On Sheet 2 it is shown applied to the "Cummer" type of wheel governors. On Sheet 3 it is shown applied to a throttling governor of common form, known as the "Waters" governor. On Sheet 4 it is shown applied to a fluid governor of common form, known as the "Allen" governor. These illustrations are sufficient to show the universality of application of my invention in steam-engine governors; and from these illustrations and the following description of my invention any person skilled in the art of constructing steam-engines or steam-engine governors can easily apply my invention to any of the many forms of governors, and therefore further illustration is not deemed necessary.

For a clear understanding of the object and purpose of my invention it is necessary to first explain the mechanical principles involved in the construction of the most perfect governors and point out the insufficiencies thereof, and then describe my construction and explain its effects. In doing this I shall only refer to the construction shown on Sheet 1 of the drawings.

(Here follow diagrams marked pp. 410 to 414, inclusive.)

Figure 1 is a side elevation of an ordinary wheel or shifting eccentric governor, and Fig. 2 is a horizontal section of the same on the line *x x* in Fig. 1.

A is a wheel mounted on the main shaft of the engine. B B are the governor weights or balls. C C are the springs which oppose

(No Model.) 5 Sheets—Sheet 1.

F. H. BALL.

ENGINE GOVERNING DEVICE.

No. 358,829. Patented Mar. 8, 1887.

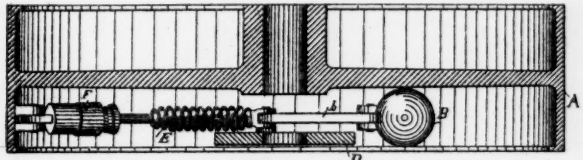


Fig. 2

No. 237
Albert L. Ide
vs.
Ball Engine Co
et al.
} p. 410

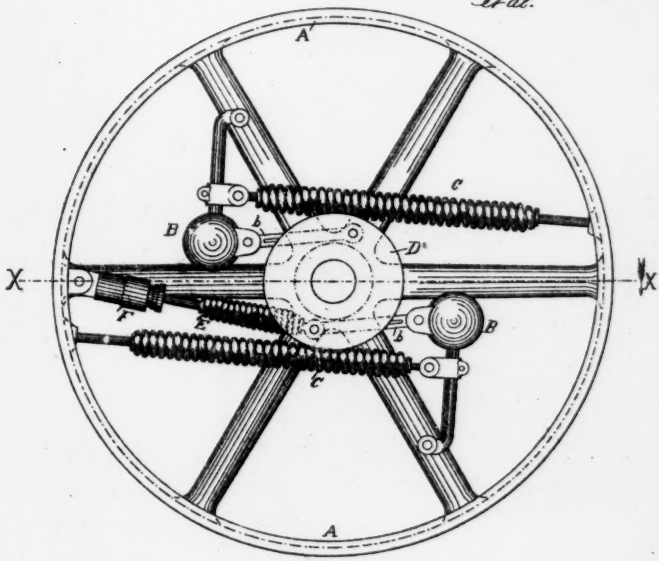


Fig. 1

Witnesses.
H. L. Reynolds
Robt. H. Porter.

Inventor.
Frank H. Ball
Per. Hallock & Wallock
Atty's.

(No Model.) 5 Sheets—Sheet 2.

F. H. BALL.

ENGINE GOVERNING DEVICE.

No. 358,829. Patented Mar. 8, 1887.

No. 224
Albert L. Ide
v.
Ball Engine Co
et al.
p. 411.

Fig. 4

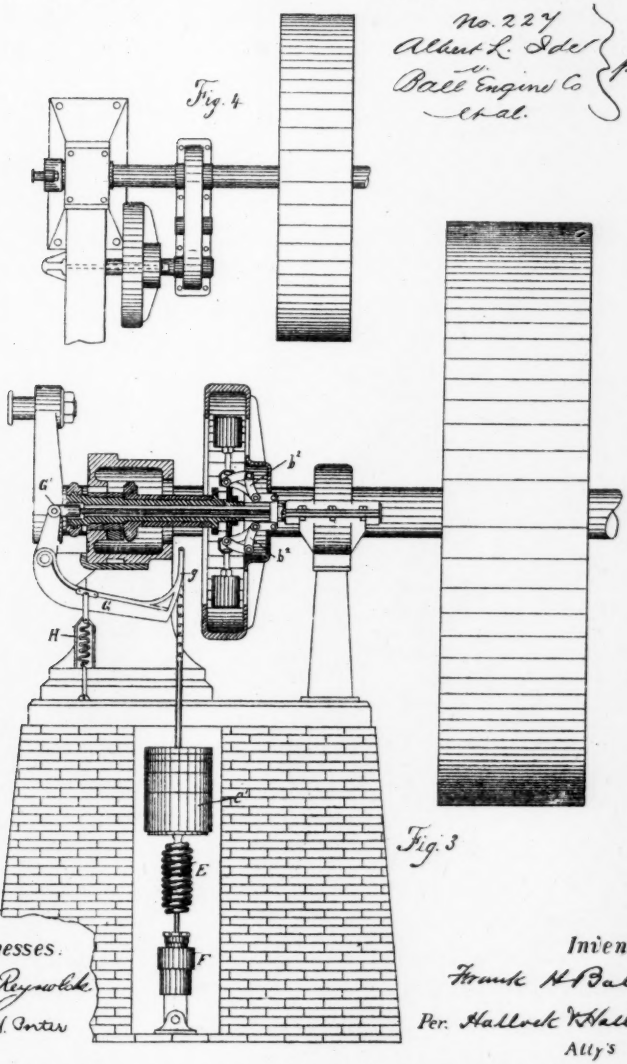


Fig. 3

Witnesses.
W. L. Reynolds.
Robt. H. Ontar

Inventor
Frank H. Ball
Per. Hallock & Hallock
Atty's

(No Model.) 5 Sheets—Sheet 3.

F. H. BALL.

ENGINE GOVERNING DEVICE.

No. 358,829. Patented Mar. 8, 1887.

no. 227. Albert L. Ide v. Ball Engine Co. et al. p. 412.

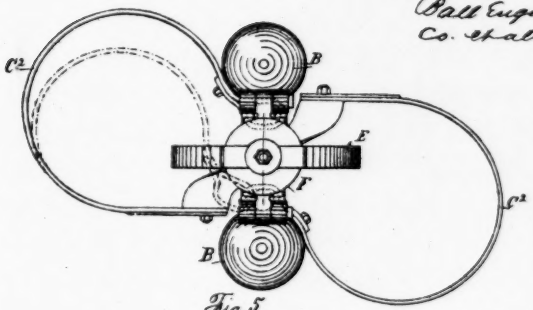


Fig. 5

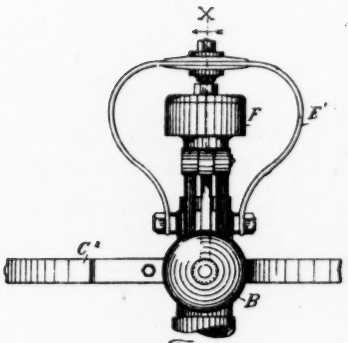


Fig. 6

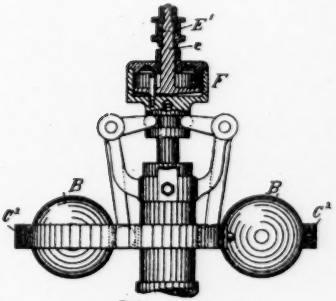


Fig. 7

Witnesses.
H. L. Reynolds
Robt. H. Porter

Inventor.
Frank H. Ball
Per. Hallock & Hallock
Att's.





(No Model.) 5 Sheets—Sheet 4.

F. H. BALL.

ENGINE GOVERNING DEVICE.

No. 358,829. Patented Mar. 8, 1887.

No. 224 Allwork 3 del } p 413
Ball Engine Co. et al.

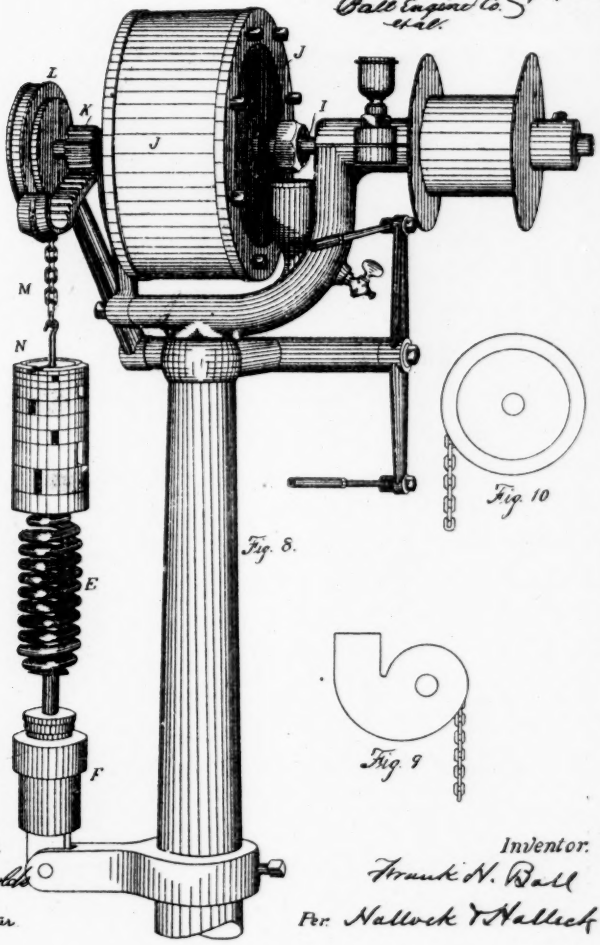


Fig. 8.

Fig. 10

Fig. 9

Witnesses.
H. L. Reynolds
Robt. H. Oxter

Inventor.
Frank H. Ball
Per. Wallock & Wallock
Atty's

(No Model.) 5 Sheets—Sheet 5.

F. H. BALL.

ENGINE GOVERNING DEVICE.

No. 358,829. Patented Mar. 8, 1887.

No. 227.
Albut L. Ide
v.
Ball Engine Co. et al
} p. 414

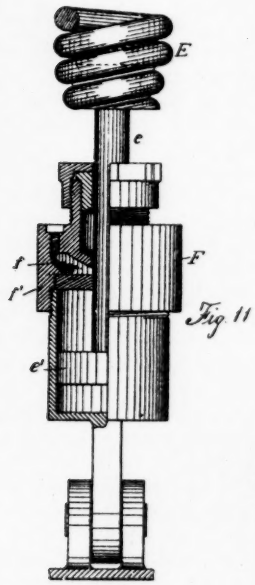


Fig. 11

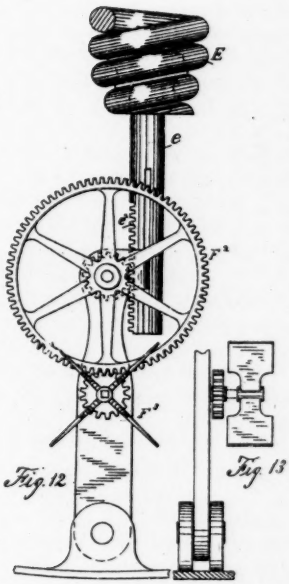


Fig. 12

Fig. 13

Witnesses.
H. L. Reynolds.
Robt. H. Porter.

Inventor.
Frank H. Ball
Per. Hallock & Hallock
Atts

the centrifugal movement of the balls. D is a disk loose on the shaft, connected to the balls by links *b b*, so that any centrifugal movement of the balls will rotate this disk, and from this disk the means for controlling the steam-supply are operated by any of the well-known appliances in common use. These latter appliances I do not show, as they form no part of my invention, and their illustration is not necessary to an understanding of my invention.

In all centrifugal governing devices the weights have a certain range of motion, within which limit their motion is confined. The position nearest the shaft is called the "initial position," and the position farthest from the shaft is called the "ultimate" or "extreme" position. The full steam-supply is given when the weights are at the initial position, which supply is reduced as the weights move toward the ultimate position, and the springs which resist this outward motion of the weights are put under a certain tension when the weights are in their initial position, which tension is called the "initial tension."

It should be here noticed that centrifugal force increases or decreases directly as the distance from the center of motion increases or decreases, and that the force of a spring under tension increases or decreases directly as the amount of its deflection or departure from a position of rest increases or decreases. Therefore it will be seen that if a weight revolving around a center of motion be held centripetally by a spring whose distance of tension is such that it would be free from strain if the weight were brought to the center of motion, and whose power is equal at any one position of the weight to the centrifugal force of the weight, then the two forces will be the same and equal at all points. This condition is what is known as the full theoretic initial tension of the spring. It has been found impracticable to construct a governor with this condition, for the reason that whenever a change of speed shall cause a change of centrifugal force sufficient to move the weights from one extreme position they would immediately move to the other extreme position, and would never rest in any intermediate
416 position, giving the engine just the required amount of steam, but would alternately throw the steam all off or all on, which action is not governing, but is commonly called "racing" or "hunting." To prevent this last-named imperfect action it has been found necessary to use somewhat less than the full theoretic initial tension, or, in other words, to have the increase and decrease of centripetal force more rapid or greater than the increase or decrease of the centrifugal force. With this adjustment it is evident that when the weight is caused to move from one position by a change of centrifugal force it will not, as before, fly immediately to its utmost limit in that direction of motion; but, on account of the differing scale or ratio of the opposing forces, the weight will stop at some intermediate point where the two forces are equal at the changed speed, and a still further change of speed will be required to move the weight again. This is what is known as a "stable" condition, because the weights seek each intermediate position with stability and remain there until a change of speed impels them to

seek another position, which they again do with stability. Each intermediate position of the weights is the result of a certain speed, and each rate of speed will bring the weights to their corresponding position. This stability of action is obtained at something of a sacrifice of uniformity of speed, for, as has been seen, each intermediate position of the weights is the result of a certain rate of speed which differs from the others, and the aggregate change of speed between the extreme positions is very appreciable. The same conditions obtain in the different types of governors shown in the drawings. In all of these, except that shown in Fig. 8, centrifugal force is used, and springs or weights are used to create the centripetal force, and these springs are all so adjusted as to give stability; but in the fluid governor shown in Fig. 8 the fan-case is kept from revolving by weights, and the cord attached to said weights winds onto a scroll-shaped spool, Fig. 9, so as to secure the stability desired.

As I have before stated, my invention is applicable to all these various types of governors; and it consists in combining with the regulating parts of the governor a spring having a gradually-yielding connection or attachment at one end, which spring is so arranged with relation to the regulating parts that it will resist the movement of said parts when a change of speed takes place, and will subsequently, when the regulating parts become stable, cease to resist by reason of its yielding attachment having moved so as to slacken the tension of the spring. This spring acts as an auxiliary to the springs and weights in the various forms of governors shown, and it also acts to oppose their action.

For example, in the wheel governor shown in Fig. 1 the spring E is the spring which I provide, and the fluid dash-pot F is the yielding connection of one end of this spring. The spring E is made with open coils, and will act both by compression and extension, and it is so connected with the disk D that the weights cannot move out without straining this spring and also the springs C C; hence here it is acting as an auxiliary to the springs C C; but after it has been strained and the weights have found their orbit of motion the dash-pot yields and the tension of the spring E is relaxed. The weights, however, cannot be thrown farther out without again straining the spring E, and they cannot fall in toward the shaft without compressing the spring E; hence here we have the spring not only acting as an auxiliary to the springs C C, but also acting to oppose their action.

In Figs. 3 and 8 it will be seen that the spring E performs the same function as in Fig. 1.

In the construction shown in Figs. 5, 6, and 7 the spring E′ is of a different form; but it performs the same office as the spring E in the other construction.

Before giving a detailed description of the constructions shown it should be stated that when my invention is used the springs or weights which furnish the centripetal force should be adjusted to give full theoretical tension. Thus in Fig. 1 the springs C C are adjusted at full theoretical initial tension, and the additional centripe-

tal force necessary to secure stability is furnished by the spring E; but when the weights become stable the yielding connection of that spring yields gradually, and as it does so the weights move a little, until they find a position which gives the exact amount of steam-supply to maintain the speed of the engine—a position the weights are unable to attain when the springs C C are adjusted with less than the full theoretical tension.

When I say, as above, that the springs or weights which furnish the centripetal force should be adjusted to give full theoretical tension, I do not wish to be limited strictly to such an adjustment, for it would be possible to make an adjustment perceptibly less than full theoretical tension, but not enough less to give stability and secure all the benefits of my invention. Any such variation from exactly full theoretical tension would either be the result of inaccurate adjustment or would be effected purposely for the purpose of evading the language above referred to. An adjustment giving absolute theoretical tension is preferable; but anything less than that and not sufficiently less to give stability is within the scope of my invention, which consists in making an unstable governor stable by the use of an auxiliary spring having a yielding connection, as above described.

The construction and application of my improvement is as follows: The spring E is an open-coil spring, and will resist both compression and extension. It is connected at one end to the regulating parts, as the circumstances require, and at the other to a fixed point through the medium of a dash-pot or other gradually-yielding connection.

417 In Fig. 11 the construction of the dash-pot is shown, and in Figs. 12 and 13 a substitute for the dash-pot, in the form of a fan escapement, is shown. Of course other well-known equivalents of the dash-pot may be employed, but require no illustration, as they will readily suggest themselves to a mechanic.

The dash-pot F is constructed as follows: It is a fluid dash-pot, consisting of a case or cylinder with a perforated piston, e', and a piston-stem, e, to which the spring E is attached. A partition, f', divides the case and forms an outer chamber, f, into which the fluid displaced by the entrance of the stem e into the main cylinder-chamber can pass.

The fan-escapement shown in Figs. 12 and 13 will be readily understood, as it is a well-known form of escapement. A rack, e^2, on the stem e meshes with a small pinion on the shaft of the large pinion F^2, which meshes with a small pinion on the shaft of the fan F^3. It will be readily seen that with either of these devices as an attachment for the spring E a sudden drawing on the spring will extend it; but if the force continues the yielding connection will gradually move and the strain on the spring will be relaxed, and also if the spring is suddenly compressed and the force continues the yielding connection will give way and the spring will expand to its normal condition.

A connection for the spring E which will at first resist and afterward gradually yield is essential to my device; but the form or type

of device which gives this gradual yielding attachment is immaterial. The dash pot is the preferable form, especially in wheel governors; but the fan may be used with good effect in the other types of governors shown.

The application of my invention to a wheel governor is shown in Figs. 1 and 2. The dash-pot is attached to the wheel, and the opposite end of the spring E to the disk D or other part moved by the action of the weights. The location of the spring E and dash-pot is immaterial, so it is so connected as to resist the movement of the regulating parts, and subsequently, when they become stable, will relax its resistance.

In the type of governor shown in Figs. 3 and 4, which is known as the "Cummer governor," the centrifugal action of the balls B B is resisted by the weight C′ and the spring H, acting on the lever G, which is connected by the rod G′ and levers b^2 b^2 with the arms of the balls B. As the cord which suspends the weights C′ winds on an arc, *g*, which is concentric with the fulcrum of the lever G, the spring H is necessary to resist the increase of centrifugal force which the balls B acquire as they move from the shaft. As this governor is ordinarily made, the spring H is given sufficient additional power to give the balls B that stability which is obtained in such a construction as that in Fig. 1 by giving the springs C C less than the full theoretical initial tension.

In applying my device to the Cummer governor I give the spring H only so much power as is required to counteract the increase of centrifugal force acquired by the balls as they move from the shaft, and thus secure the equivalent of full theoretic tension, and I then connect my spring E and dash-pot F with the weight C′, as shown in Fig. 3, where it will resist the movement of the regulating parts until they become stable, and then will yield and cease to resist, giving precisely the same effect I have before explained in connection with the construction shown in Fig. 1.

In the construction shown in Figs. 5, 6, and 7, which is a throttling governor of common form, the spring E′ corresponds in function with the spring E in the previous figures. Here I show a dash-pot attached to a part of the governor which has a vertical movement caused by the action of the balls B, and the spring E′ is attached to a part of the governor which has no vertical movement and bows or arches over the top of the governor, and takes hold of the piston-rod *e* and restrains its movement. In this construction the springs C^2 C^2, which correspond in function with the springs C C in Fig. 1, should be adjusted at full theoretic initial tension. The centrifugal movement of the balls B B is restrained by the spring E′ with precisely the same effect as are the balls B in the construction shown in Fig. 1 by the spring E.

The governor shown in Fig. 8 is what is known as a "fluid governor," and is well understood by mechanics and needs no particular explanation here. A fan on the shaft I rotates in the case J, which contains a fluid, and is left free to move within limits by the rotative action of the fan and fluid. Any such rotative movement of the case is restrained by the weight N, which is suspended by the chain M

from a spool, L. In order for the case to move rotatively, it must wind the chain M onto the spool. As ordinarily constructed the spool is made scroll form, as in Fig. 9, to cause the weight to exert a constantly-increasing resistance to the rotation of the case. In applying my invention to this type of governor I make the spool round, as in Fig. 10, and attach my spring and its yielding attachment to the weights N. With a round spool and a proper weight, N, we have the equivalent of full theoretic initial tension, as explained in connection with the wheel governor in Fig. 1, and with my spring and its elastic connection we have the additional force, which will give stability, and at the same time allow the regulating parts to seek such a position as will give uniformity of speed.

I intend hereafter to apply for patents claiming specifically the various constructions here shown and not here claimed specifically, and hereby reserve the right so to do.

I am aware that an auxiliary spring having a dash-pot connection has been applied to engine-governors, but not for the purpose, nor in the manner, nor under the conditions I apply such a spring.

Such application has been heretofore used for the purpose of
418 making the governor perfectly astatic, or for preventing the weights from moving more easily in one direction than in the other. See, for example, German patents Nos. 3875 and 6557, and English patents No. 991 of 1865 and No. 3416 of 1866. The said patents do not describe the rationale of my invention. My auxiliary spring resists the action of the weights the same whether moving in or out, and it is applied for the purpose of making an astatic governor stable—a use not contemplated or described in either of said patents.

What I claim as new is—

1. In a steam-engine governing device wherein the regulating parts are adjusted so as to give substantially an equilibrium to the opposing forces, the combination, with said regulating parts, of a spring having a gradually-yielding connection applied to resist the action of said regulating parts, substantially as and for the purposes mentioned.

2. In a steam-engine governing device, the combination, substantially as shown, of a wheel upon the engine-shaft, centrifugally-movable weights adjusted in said wheel, springs connected with said wheel, and weights so adjusted as to substantially counterbalance the centrifugal force generated by the rotation of said weights around the shaft, and an auxiliary spring having a yielding connection at one end applied to resist both the inward and outward movement of said weights, for the purposes set forth.

In testimony whereof I affix my signature in presence of two witnesses. FRANK H. BALL.

Witnesses:
ROB'T H. PORTER.
C. SWALLEY.

(Endorsed:) Filed Apr. 9, 1889. Wm. H. Bradley, clerk.

419 DEF'TS' EXHIBIT "D."

(Here follows diagram marked p. 419.)

420 DEFENDANTS' EXHIBIT "E," "CATALOGUE."

Ball Engine Co., manufacturers of automatic cut-off engines, Erie, Pa.

421 *Catalogue of Automatic Cut-off Engines Built by Ball Engine Company, Erie, Penna.*

(Here follows diagram marked page 422.)

423 *Introductory.*

In issuing this our second catalogue we are glad to say that during the four years which have elapsed since the publication of our first catalogue our engine has made many friends. Its new features have received very gratifying recognition from the purchasers of engines and from professional engineers.

The test of time has developed very little in the nature of faults, and we have endeavored to learn by experience where improvement could be made, and thus bring the engine to a higher state of perfection.

Thanking our patrons and friends for the many kind words we have received, and with the assurance that we shall endeavor to continue the pleasant relations that have existed, we remain

Yours truly, THE BALL ENGINE CO.

Erie, Pa., August 1st, 1888.

424 This catalogue is devoted to the illustration of our high-speed engines, the distinguishing features of which are found in the governor and valve.

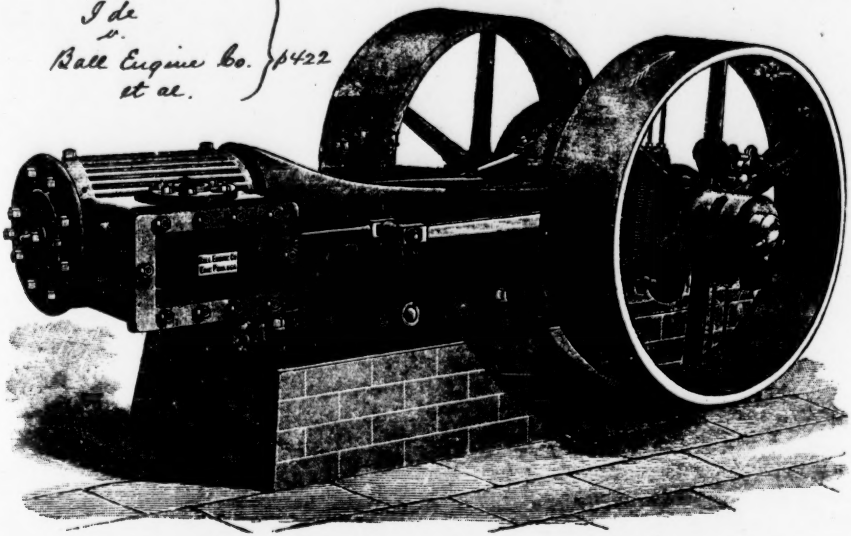
We believe, with becoming modesty, that our engine is the only one offered for sale under an iron-clad guarantee that, with the full load, the speed of the engine shall not be one revolution per minute slower than without any load, and that a decrease of boiler pressure shall not decrease the speed one revolution until the latest point of cut-off is reached.

We will endeavor briefly to explain the theory of our governor by which we are enabled to obtain this result.

Description of Governor.

To have a clear understanding of the theory of our governor, the underlying principles of a centrifugal governor must be comprehended. A brief review of these principles and their action may aid in explaining the theory to those who have not made the subject a study. The use of centrifugal force in the governing mechanism of engines has been so universal that it might almost be said that no successful governor has been made without it. In all forms of centrifugal governors weights are made to revolve around an axis, with a latitude of motion to and from the axis, which motion is made to control the steam supply. The centrifugal force of these

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weights is opposed by gravity or springs, or both, acting as centripetal force, and the action of the governor is the result of a balancing of these forces. As the weights move from the axis their centrifugal force increases directly as the distance from the axis is increased. The opposing or centripetal force may also be arranged to increase in exactly the same ratio or scale.

If so arranged, then when the speed is such that the two forces are in equilibrium in one position of the weights they will also be exactly balanced in every position from one extreme to the other at the same speed, and an engine having a governor so arranged might be expected to show the same rate of speed under every condition of load. Unfortunately, however, a difficulty is found in the nature of instability, for if the two opposing forces are adjusted with relation to each other, as described, then when a change of speed causes the weights to move from any position they will move to the extreme limit of motion in that direction, because the same difference between the two forces that causes a movement of the weights will continue to exist when they have reached their extreme limit of motion. This action of the weights produces the effect of throwing the steam all on and all off, one extreme following the other in rapid succession—a result which is called "racing" or "hunting." To prevent this and to obtain stability of action, it has been found necessary to adjust the opposing forces so that as the weights move outward the centripetal force increases more rapidly than the increase of centrifugal force, due to the larger circle in which the weights move.

425

If so adjusted, then when the weights move outward they meet with an increasing resistance and are brought to rest, when a still further increase of speed will be required to move them outward to another position.

The reverse action takes place as the weights return toward the axis, so that each intermediate position between the extremes is the result of a certain speed, the slowest speed being when the weights are nearest the axis and a regular increase of speed taking place at each stage of movement outward or from the axis. This condition of stability is therefore obtained at a sacrifice of uniformity of speed, and the greater the variation of speed between the extreme positions of the governor the greater the stability that will be obtained.

Where springs are used for centripetal force they are given a certain amount of tension with the weights in their inner position, and this tension is technically called "initial tension." The term initial tension used in this connection is used to denote the distance of stretch put on the springs, without any regard to the amount of force thus produced.

426 In considering the relation of the opposing forces in any governor we merely consider what relation the distance of initial tension bears to the distance between the weights and the axis of revolution.

What is called the full theoretic tension is where the distance of initial tension corresponds exactly with the distance between the centre of weights and centre of axis. With the full theoretic ten-

sion the two opposing forces will increase and decrease exactly in harmony as the weights move to or from the axis at the same speed, and this is the condition of adjustment that we have described as one that might be expected to produce the same rate of revolution of an engine at every condition of load but has been found impracticable on account of its instability. To obtain stability the springs must be given less than full theoretic tension or the distance of their initial stretch must be less than the distance between the weight and the axis. The less the initial tension the greater stability and the greater the variation of speed under changes or load or boiler pressure.

Weighing the Load.

Recognizing the impossibility of exact regulation with any of the known forms of centrifugal governors, numerous attempts have been made to obtain a better result by other means. Prominent among these are the various designs which were intended, without centrifugal weights, to govern the speed by a "weighing of the load." Every one of these attempts to dispense with centrifugal force has necessarily been a failure, for the very obvious reason, if for no other, that without centrifugal force the governor had no provision for governing against changing boiler pressure.

In 1878 we brought out a governor which embodied the principle of weighing the load in combination with the use of centrifugal weights. The governor was designed to be a powerful cen-
427 trifugal governor, having all the advantages of the best forms of centrifugal governors for stability and good regulation under varying steam pressure, and also so arranged that the load on the engine was made to act as centripetal force in connection with the centripetal force of the springs.

Fig. 1 illustrates this type of governor. It will be seen that the double-ended arm "A" is keyed to the shaft, and the pulley, which is mounted loosely on the hub of this arm, is driven by its connection with the ends, as shown.

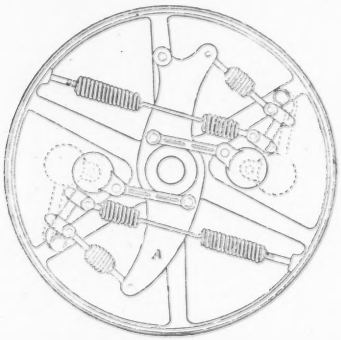


Fig. 1.

The main springs are here adjusted with less than the full theoretic tension to obtain stability, as has been described, and the effort of the engine in driving the load is made to act on the weights in such a manner that the full load will bring them from the outer position to the inner without a reduction of speed. The intermediate positions of the weights are also obtained in the same way, and by proper adjustment a uniform rate of speed may be realized under every condition of load. The practical working of this system proved to be all that theory had promised.

428 Several hundred engines were built and put into successful operation with this system of governing, and it may fairly be said that they have produced results that had never before been attained.

As has already been said, the peculiar advantage of this "weighing of the load" is only in the direction of governing against change of load. In regard to change of boiler pressure, the governor acts merely as a centrifugal governor of the ordinary type, no better and no worse than the best of that class.

Our Latest Governor.

During the past year we have applied a new principle to centrifugal governors, by which our engines not only give exact regulation under change of load, but also absolutely a uniform rate of speed under changes of steam pressure. The advantages of covering the ground so fully are apparent. The principle involved may be understood by reference to Fig. 2. The springs "D" are given full theoretic tension, which we have already described as being a distance of stretch corresponding to the distance from the centre of weight to centre of shaft. The spring "S," also attached to the weight arm, has no initial tension, and, acting in combination with the other springs, produces the effect of springs with less than full theoretic tension, giving the stability due to such a spring adjustment and, it might also be said, the same variation of speed, provided the dash pot "C" be dispensed with and the short spring attached to a fixed point instead.

The introduction of the dash pot in this connection, however, produces a very peculiar effect, and it is the combination of this dash pot with the supplemental spring that makes it possible to produce the result shown by our governor. This dash pot is a well-known device, consisting of a cylinder filled with oil and having a piston with an aperture through which this fluid may pass as the piston moves in either direction. The piston rod of dash pot

429 is attached to the supplemental spring, which arrangement provides a yielding base for this spring. This spring is arranged for either compression or extension. When motion of the governor weights take- place in either direction this spring is put under tension for the moment and performs the function of giving stability to the governor, but immediately the action of the dash pot releases the tension and the spring returns to its normal condition, in which it is not a factor in the speed of the engine,

which speed is determined entirely by the long springs, and as we have already assumed these springs to have the full theoretic ten-

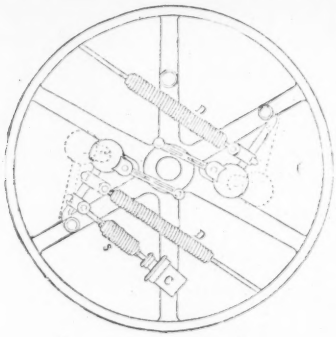


Fig. 2.

sion, the engine must show the same rate of speed at every point of cut-off without the instability formerly experienced with full theoretic tension in centrifugal governors.

Dash pots have been used more or less in governors for years, but not until we combined the dash pot with the supplemental spring has it been possible or, at least, practicable to use full theoretic tension.

430 The function of the dash pot heretofore has been to resist intermittent disturbing influences and counteract the action of unbalanced parts. Without the supplemental spring it prevents a quick and delicate action in balancing the forces and makes the governor sluggish. Its retarding influence always stands in the way of the governor, and, if even an approximation to full theoretic tension is used, the bad effects are exaggerated and the former instability or racing is only changed by the dash pot to fluctuations, each of which covers a longer period of time.

The effect of combining the supplemental spring is to allow perfect freedom for the quickest motion of the governing mechanism by deflection of the spring, which deflection furnishes stability by its resistance without preventing instantaneous motion to any desired point.

The practical working of this theory proves it to be a very happy combination of old devices for a new purpose. By its use we are enabled to widen the scope of our iron-clad contract and cover the changes of boiler pressure as rigidly as we formerly covered the changes of load only.

Among the great number of engines offered to the public we believe we are conspicuously alone in the results we produce in the direction of close regulation. It is gratifying to know that this peculiar advantage is appreciated by at least a part of the purchasers of engines.

431 The following diagram illustrates the perfection of regulation that is attained by our engines. The diagrams are the record of a "Moscrap speed-recorder," and in each case for several consecutive hours.

The distance between vertical lines represents five minutes of time and between horizontal lines three per cent. of variation of speed.

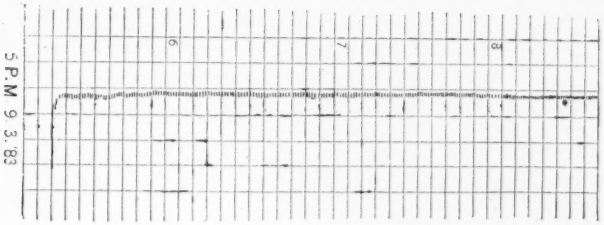


Diagram "D," showing a continuous record of speed for several hours.

Diagram "D" was made from one of our 9 x 12 engines at the Boston fair of 1883. The engine was making "Fuller" electric lights from four dynamos, which were thrown on or off at pleasure. Steam was supplied from the same boiler that furnished steam for other exhibitors and subject to the usual wide fluctuations of pressure in such cases.

The record began at 5.10 p. m. and is shown until nearly 9 o'clock. A critical examination of the diagram shows that not for one instant or for one revolution did the speed vary more than a small fraction of one per cent., which we may fairly claim to be perfect regulation.

432 As a contrast we publish diagram "E," taken with the same instrument.

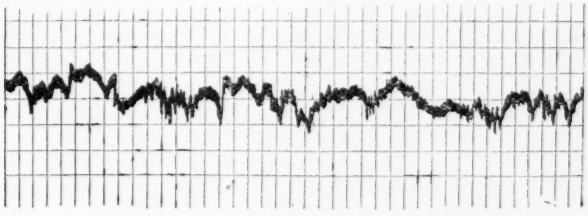


Diagram "E," a sample of not uncommon regulation.

This diagram was taken from a two hundred horse power automatic cut-off engine driving a paper mill, and is by no means an extreme case of bad governing. The engine was considered to be doing fair work.

Construction of Governor.

The governor on our engines is placed in one of the driving wheels, and the details of construction may be understood by reference to Figs. 3 and 4.

In Fig. 3 may be seen the arrangement of springs, weights, etc., and also the dash pot with its spring. The eccentric, with the parts attached, is shown in Fig. 4. "C" is a disk or flange having a sleeve encircling the shaft and a flange nut, "G," which holds the parts in place.

433 "A" is the main eccentric, having an arm, "B," the outer end of which arm is pivoted on a stud projecting from one of the arms of driving wheel. The elongated shaft opening in the eccentric allows a pendulum motion of the eccentric. This motion is controlled by the disk "C," as follows: This disk has a flange, "D,"

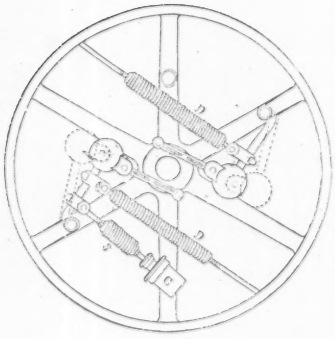


Fig. 3.

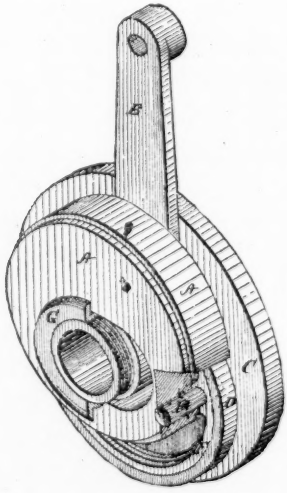


Fig. 4.

which is eccentric to the shaft, and inside this flange is a ring, "E," which engages the stud "F." This stud also engages the eccentric, which is shown by cutting away part of the eccentric in Fig. 4.

On the back of disk "C" are studs, which engage the free
434 ends of the links attached to the weights in Fig. 3. The motion of these weights is thus made to rotate disk "C," and by means of the ring and stud the main eccentric is swung across the shaft on the pivot "B" and the admission of steam thus controlled. The arrangement of one eccentric to operate another prevents any disturbance of the governor by resistance of the valve.

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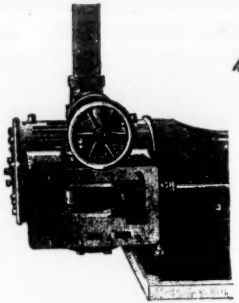


Fig. 5.

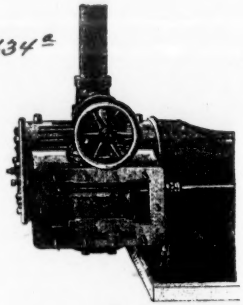


Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.

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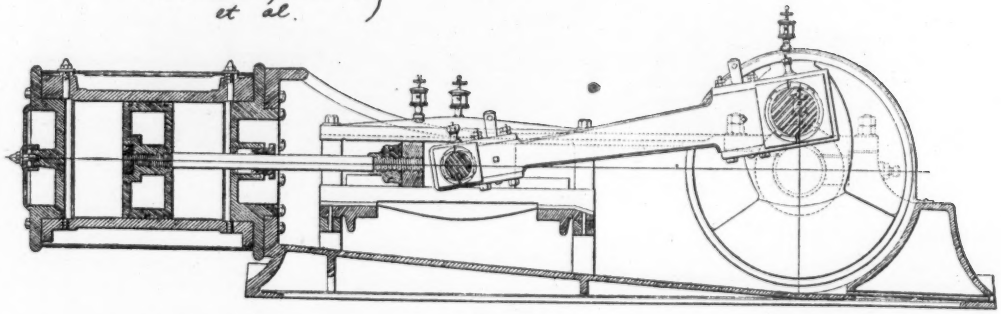


Fig. 10.

General Description of Our Engine.

Although the governor is distinctively the feature of our engine, we have endeavored to combine other desirable features which will commend themselves to the purchasers of engines. Prominent among these is our valve, which by its construction insures a high grade of economy through a long period of time, and, compared with the piston valves so commonly used in our type of engines, is often a matter of even greater importance than the more perfect regulation given by our engine.

Description of Our Valve.

Figs. 5, 6, 7, 8, 9 give a very good idea of the construction and operation of our valve. It will be seen that the valve is in two parts, which are connected by telescopic sleeves, which allow each half to adjust itself to its seat. Steam passes directly into the valve from the boiler in every position, and is distributed to either end of the cylinder by the position of valve.

Fig. 5 shows steam-chest cover removed and valve in position.

Fig. 6 shows valve removed and the ports in lower side of steam chest are visible.

Similar ports are placed directly opposite these in the upper part of the steam chest, thus making valve double-ported. The exhaust takes place over the ends of valve and into steam chest, which is always filled with exhaust steam and is—

(Here follows diagram marked p. 434*a*.)

436 in direct communication with exhaust pipe through openings in the lower corner of steam chest at each end. Each half of valve is held in contact with its seat by direct steam pressure, and the wear is thus followed up.

Fig. 7, 8, and 9 are views of the valve.

The sleeves are made of a size that will just give sufficient pressure against each valve seat to insure good contact.

It must be admitted that no better or more serviceable valve has ever been devised, and its superiority over any form of piston valve is too obvious to be questioned. It is very common for the builders of piston-valve engines to undertake to overcome the "prejudice," as they call it, against that form of valve. Our valve needs no defence or apology.

Inspection of the Valve.

Another feature is the opportunity to inspect the valve when in operation, under boiler pressure, by removing the steam-chest cover, thus enabling us to detect any leakage and scrape the surfaces until absolutely tight.

Details of Our Engine.

Fig. 10, which is a sectional view through the centre of our engine, gives a very good idea of the details of construction.

(Here follows diagram marked p. 436*a*.)

438 *Crank Shaft.*

The crank shaft is a solid continuous steel casting or forging from one end to the other and is not "built up" of detached parts. The crank pins in every case are the same diameter as the journals. Both the crank pins and journals are carefully ground and polished. The disks which contain the counter-balance are fitted and keyed to the cranks by a new process just adopted by us, which insures their remaining in place.

Connecting Rod.

The connecting rod and straps are made of forged steel, carefully fitted up and highly finished. The rod boxes are cast-iron shells, lined with a special Babbitt metal. The cast iron is free from excessive expansion from heat, and the Babbitt, besides being highly anti-friction, will not injure the pin in case of accident.

Cross-Head.

The cross-head has very large wearing surfaces, being the full length of the stroke of the engine in every case. The pins are of hard steel, accurately finished and pressed into place. Both the cross-head and guides and all flat wearing surfaces are scraped to surface plates.

Piston.

The piston is screwed on the rod and secured with a lock not let into the piston, as shown. The rings are light cast-iron rings sprung into grooves in the surface of piston.

439 *Economical Development of Power.*

In comparing the economy of steam plants it is necessary to consider not only the fuel economy obtained, but also the investment per horse power in the plant, as well as its adaptability to the work, its security from being shut down by accident, and many other points that bear on the question of economy in the broad sense of the word.

The nature of the work to be done and all the surrounding conditions must be considered in arranging a steam plant.

Where the work is reasonably constant in amount a single engine is unquestionably more economical in fuel consumption than two or more engines, but in many cases, as in electric lighting, a division of the power into several units is found to be more economical of fuel because the necessity of running the large engine through many hours each day when the load is so small that the friction of counter-shafting and engine and its condensation will necessarily



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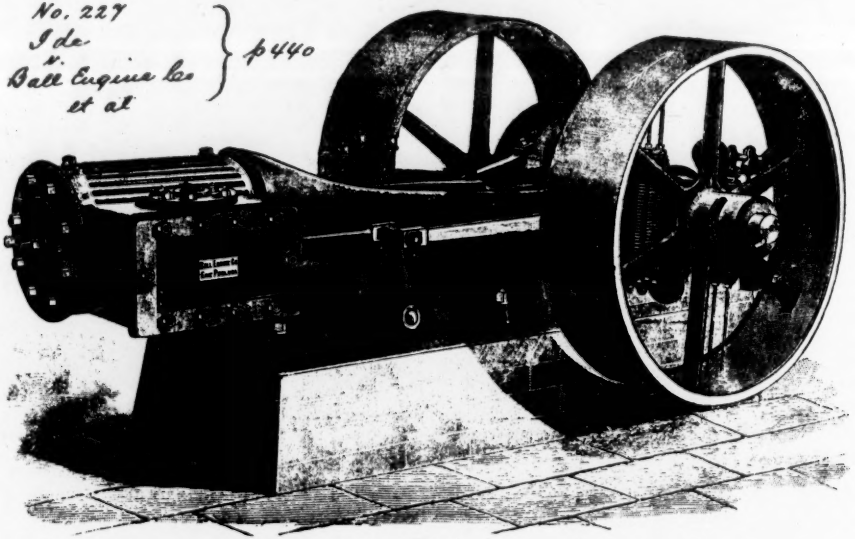


Fig. 11.

consume very much more steam than would be required to drive a small engine with its load. Under these conditions not unfrequently the large engine must develop three or four horse power for every one horse power of effective work done.

A reasonable division of the power has also the advantage of enabling a lighting company to grow by adding another engine and dynamos as the business requires it.

Security Against Accident.

Almost perfect security against accident may be made by dividing the power and having a reserve engine always ready to start.

(Here follows diagram marked p. 440.)

441 Probably no better, safer, or more economical arrangement of a steam plant for electric lighting can be made than moderately large self-contained engines, each of which drive two or more dynamos direct by belt from the engine wheels.

The original cost of a plant of this kind is small and its advantages are too many and too obvious to be overlooked.

It seems to be almost universally conceded by those experienced in electric lighting that the most successful engine for that business is the

Self-Contained High-Speed Engine.

We make a specialty of this type of engine, as represented by Fig. 11.

The remarkable success of our high-speed engines has effectually answered the predictions of many that engines of this class would be short-lived.

Their capability of long continuous runs and the imperceptible wear which they show is due in part at least to large wearing surfaces, superior material used, perfect workmanship, and perfect lubrication; but all of the foregoing cannot fully explain the unexpected long life of this class of engines, and other causes must contribute to this result.

Of these we will speak further on when considering the effect of inertia of the reciprocating parts in modifying the distribution of work in the crank-pin.

Indicator Cards.

Figs. 12, 13, 14, 15 are samples of indicator cards taken from our engines.

Their general characteristics are those of the single valve automatic cut-off now so familiar since the universal favor into which this class of engines have come.

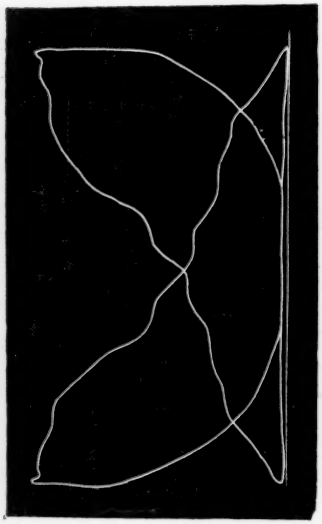


Fig. 13.

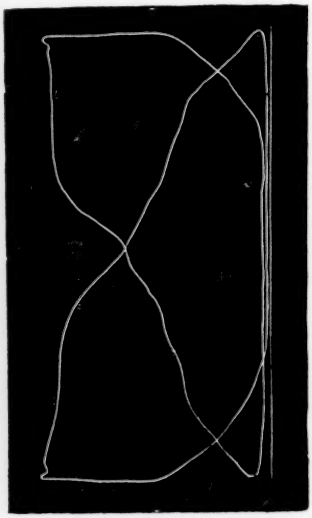


Fig. 15.

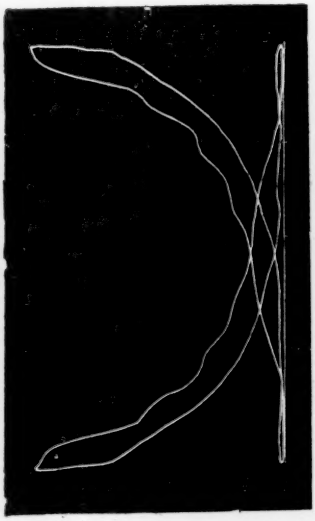


Fig. 12.

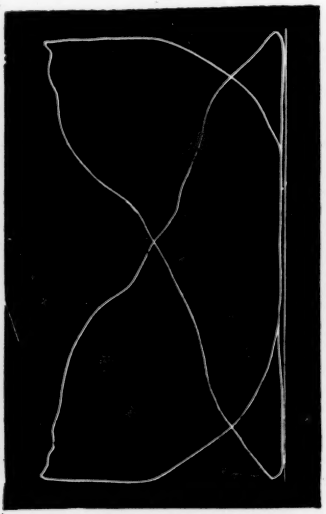


Fig. 14.

443 The cards speak for themselves and will bear a critical inspection.

We will not undertake to give a treatise on indicator cards, as this subject is so generally understood, but will furnish a few tables for convenience in making calculations, and will endeavor to present the subject briefly in a manner intended to assist engineers in working up diagrams without going into the theory on which the tables are based.

To Compute the Indicated Horse Power of a Diagram.

Referring to Fig. 16, having noticed the scale of the diagram, next proceed to ascertain the mean effective pressure. This is done either by following the outline of the diagram with a planimeter, if one is at hand, or, if more convenient, the diagram may be divided into any number of spaces and vertical lines erected through the centre of each space.

In Fig. 16 ten spaces are used and ordinates placed in the middle of each of the ten spaces.

The combined length of these ten ordinates divided by ten gives their average length, and this, measured by the scale of the diagram, is the average or mean effective pressure. Where several diagrams from the same engine are to be measured it is most convenient to calculate the horse power of one pound mean effective pressure, and it is then only necessary to multiply the mean effective pressure of each diagram by this result to ascertain its indicated horse power.

Hence the following rule:

Multiply the area of the piston by the number of feet it travels per minute and divide this result by 33,000. This product is the horse power of one pound mean effective pressure, and if multiplied by the mean effective pressure of any diagram from this engine will give its indicated horse power.

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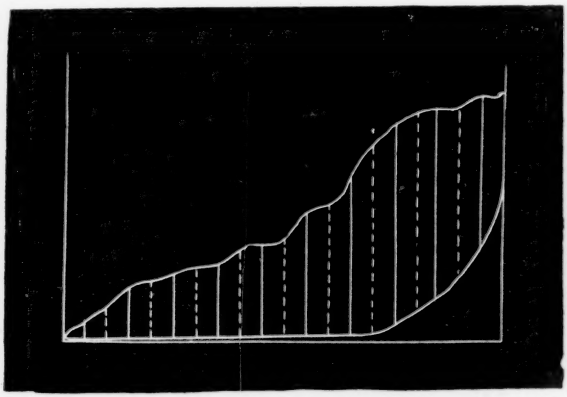


Fig. 16. Scale, 60.

13 x 12 engine, 300 rev.; M. E. P., 41.25; I. H. P., 99.40.

445 *Example.*

Fig. 16 is a diagram from a 13 x 12 cylinder with 300 revolutions or 600 strokes per minute. The area of a 13-inch piston is 132.73 inches. Piston travels 600 feet per minute.

$$\frac{132.73 \times 600}{33{,}000} = 2.41.$$

Hence the horse power developed by one pound mean effective pressure is 2.41.

Referring to Fig. 16, the combined length of the ten ordinates is 6⅛ inches, or measured with the scale of the diagram is 412.5, which, divided by ten, gives 41.25 as the mean effective pressure of the diagram. This result multiplied by the horse power of one pound, 2.41, gives 99.41 as the indicated horse power of the diagram.

The Expansion Curve.

The expansion curve of any diagram should conform approximately to the theoretic curve.

The theoretic curve, commonly used for comparison, is easily traced, and is called the isothermal curve because it disregards the change of temperature by expansion.

The real curve which recognizes these slight changes of volume, caused by changes of temperature, is called the adiabatic curve; but, being very difficult to construct, is not used. It differs very slightly from the isothermal curve.

446 *The Theoretic Curve.*

To construct the theoretic curve for any diagram, first draw the vacuum line V M, Fig. 17; then erect the line M N, making the distance from the diagram represent the clearance space of the engine. Thus: If the clearance is 10 per cent., the distance laid off between this line M N and the diagram will be 10 per cent. of the total length of diagram. Where the clearance is not known an approximation may be made in the following manner:

Construct a rectangle of any convenient size, as A B C D, Fig. 17, with its base parallel to the vacuum line V M. Let this rectangle have two of its angles, A and C, rest on the compression curve, and draw a line through the angles B and D, extending this line to its intersection of the vacuum line. This point of intersection, "M," will be the point from which to erect the clearance line M N.

The same law governs the expansion curve, and by the reverse process any point on the expansion curve may be selected, and the theoretic curve traced in either direction.

In Fig. 17 this method is used to continue the expansion curve from G to T, and also back from G to E.

Illustration.

Having selected the point G, next draw the line G H parallel to V M; then draw the line H M, and complete the figure by drawing the vertical line G F and the line F T parallel to H G.

The Fig. G H T F has parallel sides and four right angles. T F is parallel to V M.

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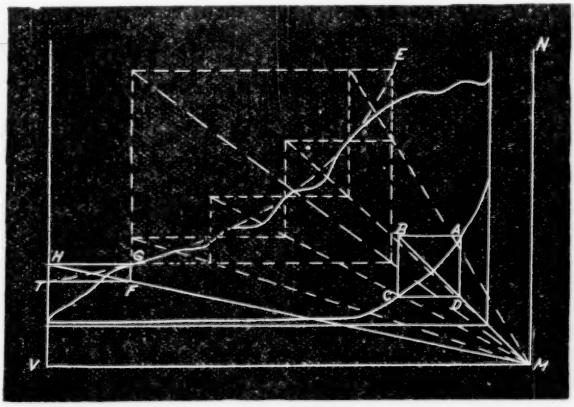


Fig. 17.

448 The line H M passes through opposite angle H and F, and inasmuch as G is a point in the expansion curve, T will also be.

The point T is called the terminal pressure, if measured from the atmospheric line, or, if measured from vacuum, is called the total terminal pressure.

In Fig. 17, T V is the total terminal pressure and measures 31 pounds. This measurement is used in calculating the theoretic water consumption, as will be explained further on.

The Theoretic Water Consumption.

To compute the theoretic water consumption of any diagram, or the water accounted for by the indicator, the following table will be found convenient.

With the use of this table it is only necessary to know the mean effective pressure and the total terminal pressure of a diagram, and no attention need be paid to the size of the engine which produced the diagram.

449 *Table for Computing Theoretic Water Consumption.*

M.	W.	M.	W.	M.	W.	M.	W.
5	7.01	29	1.12	53	.60	77	.43
6	5.61	30	1.09	54	.59	78	.43
7	4.82	31	1.07	55	.58	79	.42
8	4.22	32	1.02	56	.57	80	.42
9	3.78	33	.99	57	.56	81	.41
10	3.44	34	.97	58	.55	82	.41
11	3.13	35	.94	59	.54	83	.40
12	2.79	36	.91	60	.53	84	.40
13	2.69	37	.89	61	.52	85	.39
14	2.51	38	.87	62	.51	86	.39
15	2.32	39	.85	63	.50	87	.38
16	2.18	40	.82	64	.50	88	.38
17	2.03	41	.80	65	.49	89	.37
18	1.91	42	.78	66	.49	90	.37
19	1.79	43	.76	67	.48	91	.36
20	1.69	44	.74	68	.48	92	.36
21	1.61	45	.72	69	.47	93	.35
22	1.51	46	.70	70	.47	94	.35
23	1.44	47	.69	71	.46	95	.34
24	1.39	48	.67	72	.46	96	.34
25	1.32	49	.66	73	.45	97	.33
26	1.28	50	.64	74	.45	98	.33
27	1.21	51	.63	75	.44	99	.32
28	1.18	52	.61	76	.44	100	.32

NOTE.—Where fractions appear in the mean effective pressure the nearest whole number may be used or a number may be selected between the two numbers in column W. which shall correspond to the fraction.

450 *Rule.*

Find in column "M" a number representing the mean effective pressure of the diagram; take the number opposite in column "W" and multiply it by the total terminal pressure, and the result will be the theoretic water consumption per horse power per hour, subject, however, to a correction for clearance, as explained below.

Correction for Clearance.

Having obtained the theoretic water consumption by the foregoing table, a correction for the clearance space must be made in the following manner:

Referring to Fig. 18, having located the terminal pressure "T," as already described, draw the line T O parallel to the vacuum line V M.

With the scale of the diagram or any other convenient scale, measure the distance T P and T O, and taking the result obtained from the table, divide it by T O and multiply this product by T P and the last result will be the theoretic water consumption per horse power per hour, corrected for clearance, and is called the water accounted for by the indicator.

Example Required to Find the Water Accounted for by the Indicator in Diagram Shown in Fig. 16.

The mean effective pressure of the diagram is 41.25 and the total terminal pressure 31 lbs.

Referring to the table, we find the number 41 in column "M," and opposite in column "W" is found .80, which amount, multiplied by the total terminal pressure, 31, gives us 24.80.

451

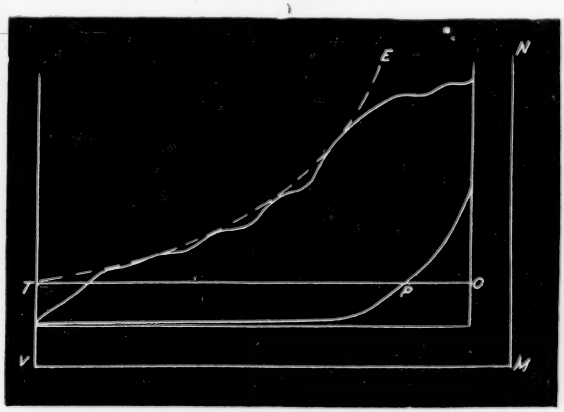


Fig. 18.

452 To make the correction for clearance we find the distance T O, in Fig. 18, to be 157, measured by the scale of the diagram, and T P is 133. We therefore divide by 157 and multiply by 133.

$$\frac{24.80 \times 133}{157} = 21.00$$

This gives us 21 lbs. as the water accounted for by the indicator per horse power per hour.

The actual water feed to the boiler will exceed this amount by just the amount wasted by leakage in the boiler and engine and

pipes and the water mechanically entrained in small particles in the steam, together with the water of condensation in the cylinder and pipes. These various causes add materially to the water consumption.

The basis of comparison between engines must necessarily be in their water consumption, as the question of fuel involves the boiler performance also. A very economical engine may appear to require a large consumption of fuel by reason of poor boiler duty. A good result can only be obtained when both boiler and engine perform their part economically.

It is the duty of the boiler to evaporate a certain number of pounds of water per pound of coal consumed, and its performance should be ascertained by test.

The Effect of the Reciprocating Parts in High-Speed Engines.

It is admitted that high-speed engines show less wear than was expected, even after making due allowance for large wearing surfaces, superior material and workmanship, and improved methods of lubrication, and in looking further for a reason it is fully demonstrated that the reciprocating parts of the engine, which are generally supposed to be an element of destruction by reason of their weight and the rapid change of direction of their motion, are in fact an element of safety and are conducive to cool, quiet running and long life of the engine.

453 Referring to Fig. 19, we notice that during the early part of the stroke the pressure on the piston is very great, amounting to 90 lbs. per square inch, or a total pressure of 11,945 lbs. At mid-stroke the pressure has fallen to 5,309 lbs., and continues to fall rapidly as the piston advances; therefore the work done on the piston is mostly done during the first quarter of the stroke.

In transmitting this work to the crank pin, the piston, cross-head, and connecting rod materially modify by their weight and inertia the distribution of work on the crank pin.

Thus during the first half of the stroke, when the reciprocating parts are being rapidly accelerated in motion, they absorb a large part of the work done by the steam on the piston, and after mid-stroke give off the same amount of work on the crank pin in coming to rest.

All the work done on the piston (less friction) is transmitted to the crank pin, but the crank pin is shielded from the tremendous blow which the impact of steam on the piston would otherwise give, and the effort is distributed throughout the whole stroke.

This modifying effect of the reciprocating parts is easily measured, and with the use of the accompanying table any engineer can readily construct a diagram of the effort on the crank pin of his

engine, using indicator diagrams from the engine as the basis of his calculation.

The table which we publish is made from calculations based on the well-known law of falling bodies, and with this knowledge of the distance a given mass will be moved in a given time by a given force (gravity), it is easy to determine what force will be required on the piston of an engine to move a given weight (the reciprocating parts) through a given distance (a certain part of the stroke) in a given time.

454 The force required to impart motion to the reciprocating parts is greatest at the beginning of the stroke, and the diagram is therefore divided into a number of spaces and the calculation is made for each of these spaces.

Diagram of Work Done on the Crank Pin.

In constructing diagrams of work done on the crank pin it is first necessary to make what is termed the real diagram of effort on the piston. An indicator diagram taken from either end of the cylinder shows what took place on that end of the cylinder during two strokes or one revolution. The upper line of the diagram was made during one stroke and the lower line during another.

The real diagram which we have spoken of is a diagram for one stroke only and recognizes what is taking place on both sides of the piston. Thus, if two indicators are used, one indicator traces the upper line while the other is tracing the lower.

Referring to Fig. 19, we will construct the real diagram by combining the upper line of the left-hand diagram with the lower line of the right-hand diagram and thus obtain the real diagram as shown in Fig. 20. This shows us that at the beginning of the stroke the pressure on the piston was 90 lbs. per square inch, and if the piston was 13 inches diameter the total pressure was 11,945 lbs.

The pressure fell rapidly as piston advanced until the point "A" was reached, when the forward effort on the piston entirely ceased, and for the remainder of the stroke the effort on the piston was in the opposite direction, as shown by the space enclosed in A B C.

455 It will be noticed, however, that if the diagram which precedes the point "A" be measured and the triangle A B C subtracted from it, the remainder will just equal the indicated power of one of the diagrams in Fig. 19, from which it is made, so that it is not a question of loss of power but simply of distribution of the work during each stroke.

NOTE.—Where diagrams from both ends of the cylinder are not available the lower line of the single diagram obtained may be reversed in position and it will be a fair substitute for the lower line of the diagram from opposite end of cylinder.

Having constructed the real diagram, Fig. 20, we next divide it into ten equal spaces by the vertical ordinates 1, 2, 3, &c.

We are now ready to construct the diagram of effort on the crank pin.

Knowing that during the first half of each stroke a certain part of the work done on the piston is absorbed by the reciprocating parts, as already explained, we must ascertain the amount thus absorbed at each of the ordinates, and having measured it off on the ordinates we are prepared to draw a line through these points and show a diagram of the work done on the crank pin. We know, also, as already explained, that after mid-stroke the reciprocating parts, in being brought to rest, give off on the crank pin the work stored up in them, and this amount is ascertained and added to the length of ordinates after mid-stroke, thus completing the diagram.

Fig. 21 is a diagram of effort on the crank pin of a 13 x 12 engine making 300 revolutions per minute with 348 lbs. weight of reciprocating parts. It is taken from diagram shown in Fig. 19 and Fig. 20 and is for the return stroke, which is the stroke in which the crank moves from the cylinder. The forward stroke is the opposite one, where the crank moves toward the cylinder. A slight difference in the rate of acceleration makes it necessary to make this distinction between the strokes. In the forward stroke the ordinates are numbered from the opposite end, the numbering in each case beginning at the large end of diagram.

The following table gives the measurement on the ordinates of a diagram representing the force in pounds pressure per square inch on the piston required to impart motion to the reciprocating parts during the first half of each stroke (called the accelerating force) and the corresponding force given off during the latter half of stroke (called retarding force).

456 *Table of Accelerating and Retarding Forces.*

For an engine making one revolution per minute, with one-inch crank, one lb. weight of reciprocating parts, and one square inch of piston area.

Forward stroke.		Return stroke.	
No. of ordinate.	Accelerating force to be subtracted from length of ordinates.	No. of ordinate.	Accelerating force to be subtracted from length of ordinates.
0	.000023	0	.000033
1	.000021	1	.000025
2	.000017	2	.000018
3	.000013	3	.000011
4	.000008	4	.0000038
5	.0000023		
	Retarding force to be added to length of ordinates.		Retarding force to be added to length of ordinates.
		5	.0000023
6	.0000038	6	.000008
7	.000011	7	.000013
8	.000018	8	.000017
9	.000025	9	.000021
10	.000033	10	.000023

Rule.

Square the number of revolutions per minute. Multiply this product by the length of crank in inches and this product by the weight of reciprocating parts. This last product divide by the area of piston in inches and the result will be the constant number with which to multiply the measurements on ordinates given in table.

NOTE.—This table is based on the table published by Charles T. Porter in his work on the "Richards indicator," and may be relied upon as quite correct. It is made for engines having their connecting rod six times the length of crank, which is now almost universal. Where 5 or 7 cranks is the length a slight difference in diagram would be found.

457 *Example*

Required to find the measurements on the ordinates of diagram No. 20, representing the accelerating and retarding forces, supposing the engine to be a 13 x 12, making 300 revolutions per minute, with reciprocating parts weighing 348 lbs.

$$\frac{300^2 \times 6 \times 348}{132.73} = 1415806.52.$$

The constant is therefore 1415806.52. Multiplying all the numbers in the table for return stroke by this constant, we have:

Accelerating force to be subtracted from length of ordinates.	No. of ordinates.	Retarding force to be added to length of ordinates.	No. of ordinates.
.000033 × 1415806.52 = 46.72	0	.0000023 × 1415806.52 = 3.25	5
.000025 × " = 35.40	1	.000008 × " = 11.32	6
.000018 × " = 25.48	2	.000013 × " = 18.40	7
.000011 × " = 15.57	3	.000017 × " = 24.06	8
.0000038 × " = 5.38	4	.000021 × " = 29.73	9
		.000023 × " = 32.56	10

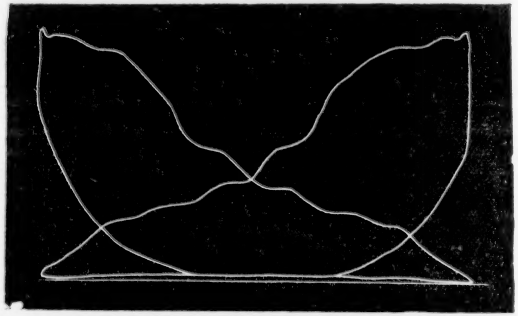


Fig. 19.

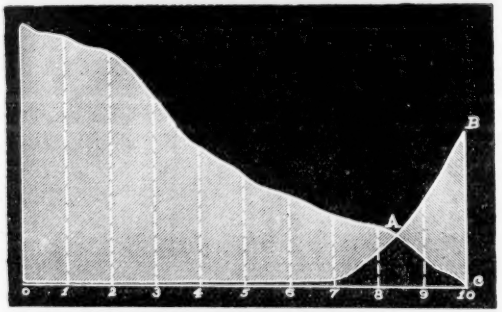


Fig. 20.

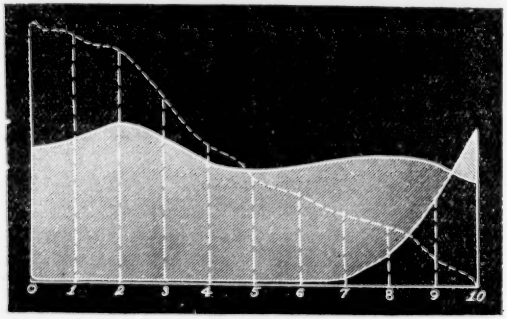


Fig. 21.

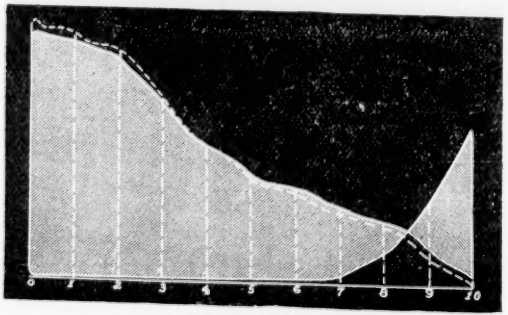


Fig. 22.

459–461 *Comparison with Slow-Speed Engines.*

Fig. 22 illustrates a crank-pin diagram such as would be produced from Fig. 19 supposing the engine to be a 13 x 12, with reciprocating parts weighing only 150 lbs. and running at 150 revolutions per minute.

In comparing diagrams 21 and 22 it is noticeable that with the high-speed engine the distribution of work is tolerably uniform throughout most of the stroke, and that the greatest pressure on the crank pin at any time is 7,260 lbs., while with the slower-running engine, as shown in Fig. 22, the distribution is very unequal and the pressure reaches 11,484 lbs., as against 7,260 lbs. with the high-speed engine. It must be admitted that Fig. 21 shows the best distribution of work.

462 & 463 DEFENDANTS' EXHIBIT F, CIRCULAR.

Illustrated Circular of the Ball Engine Co., Manufacturers of Automatic Cut-off Engines Embodying a New System, in Which the Governor Weighs the Load.

* * * * * * *

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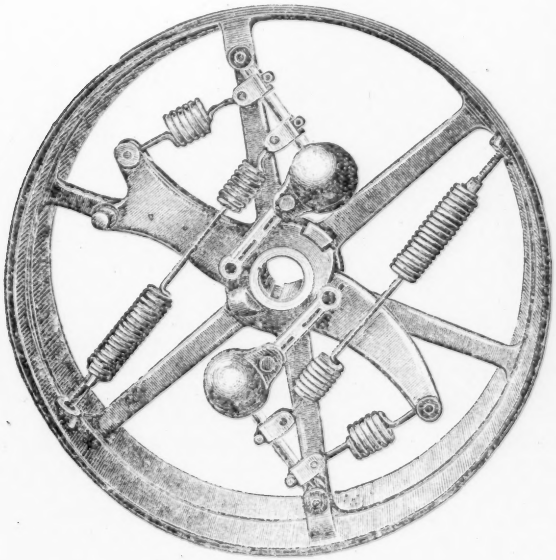


Fig. 1.

Fig. 1 is an illustration of our governor with eccentrics detached, which appear in Fig. 2. The theory of this governor is based on

the logical principle that if a varying load requires a change of steam-supply this change should be the direct result of the load and should exactly correspond with it. In other words, the governor of a steam-engine should not depend upon the very variation of speed which it is intended to obviate for its motive power to act, but should recognize the variation of load, thereby becoming a weighing machine, the result of this weighing being a corresponding change in the steam-supply, thus making it possible to maintain absolutely uniform speed. Comparing the two systems, we see that with the old systems the supply of steam is in proportion to the speed, but with the new system the supply is in proportion to the load and the speed is constant.

465

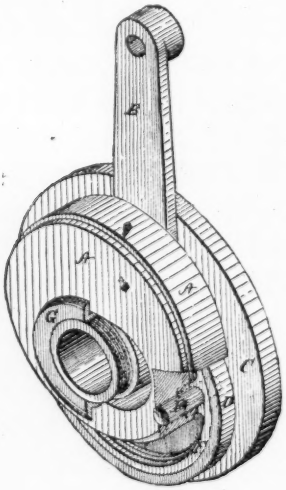


Fig. 2.

Fig. 2 shows the eccentric which forms a part of the governor. "*A*" is the main eccentric, having an elongated shaft opening. To this eccentric is attached the arm "*B*," whose outer end is pivoted, thus allowing the eccentric a pendulum motion across the shaft, which motion controls the duration of time in which steam is admitted during each stroke. This pendulum motion is controlled by the rotation of the disk "*C*" at its side in the following manner: This disk has a flange, "*D*," on its side, which is eccentric to the shaft, and on the inside of this eccentric flange is a ring, "*E*," which engages with a stud, "*F*," in the main eccentric, as shown. Thus it will be seen that the rotation forward and backward of this disk causes the main eccentric to swing across the shaft, as previously mentioned. This disk also has a sleeve encircling the shaft and projecting through the elongated shaft opening in main eccentric, and on the end of the sleeve is a flange nut, "*G*," which holds the

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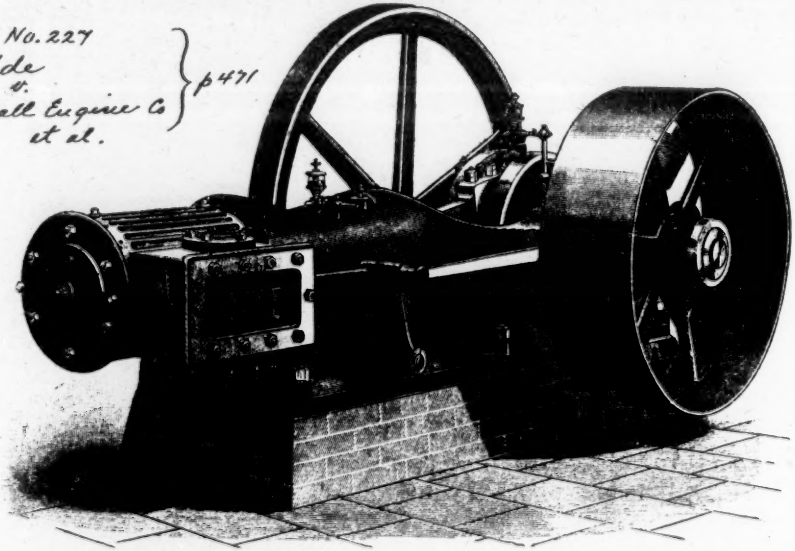


Fig. 3.

parts all in place. The rotation of this disk is produced and controlled by the governing forces. These forces are, 1st, the centrifugal force of the weights opposed by suitable springs; 2d, the resistance of the load or work being done opposed by the centrifugal force of the weights.

The result of these combined forces is communicated to the disk by means of links connecting the weights with studs on the outside of disk, so that as the weights move from or toward the center the disk is made to rotate. These weights are pivoted on the arm of the pulley, which pulley is the driving pulley of the engine and is mounted loosely on the hub of a fixed arm, this arm being keyed to the shaft. The driving of the pulley is all done from the outer ends of this fixed arm, the connections being so arranged that a weighing of the resistance is effected. In the process of weighing, the pulley turns slightly backward or forward on the shaft, and the weights are thus drawn inward or allowed to move outward as the load is increased or diminished. Thus it will be seen that the combined forces employed give all the advantages of a centrifugal governor for stability of action and regulation against changing boiler pressure, and the weighing process obtains exact uniformity of speed under varying loads. The process of governing may be briefly described as follows: Suppose the engine to be started without any load. As the speed approaches the desired point the weights of the governor acquire centrifugal force sufficient to overcome the springs, and they move outward, cutting off the steam and restraining the engine within the prescribed limits of speed. Now, if work be put upon the engine the usual process is for the momentum of the engine to be overcome, reducing its speed until the loss of centrifugal force in the weights allows the springs to draw them into a position that will admit the necessary amount of steam to meet the load, and if still more load be added the speed is reduced still further, etc. In the case of our governor the addition of load does not overcome the momentum of engine, but acts directly on the weights, drawing them into a position that admits the necessary steam. When load is thrown off, the weights are immediately released, just in proportion to the change of load. In this way the conditions of load are communicated directly to the steam-valve without going through the engine, and the change of load on the belt is met by a corresponding change of steam in the cylinder, the two being simultaneous.

466–501

The successful application of this new force, producing as it does a result so long sought and never before obtained, is a matter of no small importance in the development of the steam-engine, and particularly so since the demand in this particular has of late been so exacting.

We publish herewith several speed diagrams illustrating the practical result of this system of governing.

(Here follows diagram marked p. 471.)

* * * * * * *

502 NORTHERN DISTRICT OF ILLINOIS, *ss:*

I, William H. Bradley, clerk of the circuit court of the United States for said northern district of Illinois, do hereby certify the above and foregoing to be a true and complete transcript of the record of all the proceedings had in said court in the cause wherein Albert L. Ide is complainant and Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland are defendants, as the same appear- from the records and files of said court now remaining in my custody and control.

Seal of Circuit Court U. S., Northern Dist. Illinois, 1855.

In testimony whereof I have hereunto set my hand and affixed the seal of said court, at my office, in Chicago, in said district, northern division, this fifth day of September, 1889.

WM. H. BRADLEY, *Clerk.*

503 Supreme Court of the United States, October Term, 1892.

ALBERT L. IDE, Appellant,
v.
BALL ENGINE COMPANY *et al.*, Appellees. } In Equity. # 227.

Stipulation.

It is stipulated and agreed by and between the parties to the above-entitled cause, represented respectively by their solicitors and counsel, that in the printing of the record in this court the following selections from the following exhibits may be used and the remaining parts of said exhibits shall be omitted, to wit:

First. That as to Complainant's Exhibit Buckeye Engine Catalogue of 1887, drawings or photolithographs of Fig. 4, page 8; of Fig. 11, page 15, and of Fig. 15, page 26, shall be included, together with the following letter-press, which in said exhibit refers to said Fig. 15, and beginning with said Fig. 15, on page 26, and ending on page 28 with the words "satisfaction can always be given."

Second. That as to "Defendants' Exhibit E, catalogue of Ball Engine Company of 1884, drawings or photolithographs of Fig. 1, on page 4; Fig. 2, on page 5, and Fig. 3, on page 11, shall be included, together with letter-press of said catalogue beginning with 'Fig. 1 is an illustration,' on page 4, and ending with the words 'we publish herewith several speed diagrams,' on page 6."

CHARLES K. OFFIELD,
Solicitors and of Counsel for Albert L. Ide.
J. H. RAYMOND,
Solicitors and of Counsel for Ball Engine Company.

Chicago, December 31, 1892.

504 [Endorsed:] Case No. 13,836. Supreme Court of the U. S., October term, 1892. Term No., 227. Albert L. Ide, appellant, *vs.* The Ball Engine Co. *et al.* Stipulation to omit parts of record in printing. Office Supreme Court U. S. Filed Jan. 6, 1893. James H. McKenney, clerk.

Endorsed on cover: Case No. 13,836. N. Illinois C. C. U. S. No. 227. Albert L. Ide, appellant, *vs.* The Ball Engine Company, F. H. Ball, James McBrier, and P. S. Kingsland. Filed October 19, 1889.

Office Supreme Court U. S.
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JAMES H. McKENNEY,
CLERK.

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, A. D. 1892.

TERM No. 227.

ALBERT L. IDE, *Appellant,*
vs.
THE BALL ENGINE COMPANY ET AL., *Appellees.*

IN EQUITY.

Appeal from the Circuit Court of the United States for the Northern District of Illinois.

BRIEF AND ARGUMENT FOR APPELLANT

BY

C. K. OFFIELD.

BARNARD & GUNTHORP, PRINTERS, CHICAGO.

IN THE

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ALBERT L. IDE, *Appellant,*
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IN EQUITY.

Appeal from the Circuit Court of the United States for the Northern District of Illinois.

BRIEF AND ARGUMENT FOR APPELLANT

BY

C. K. OFFIELD.

This is an action in equity brought at the Seventh Circuit below in the United States Circuit Court for the Northern District of Illinois by the appellant, Albert L. Ide, for the infringement of his Letters Patent, dated July 8, 1884, No. 301,720, for a new and useful improvement in steam engine governors.

The complainant-appellant in this case holds the triple position of inventor, manufacturer and complainant litigant, he having established his business as engine builder at the city of Springfield, in the State of Illinois, at a time closely approximate the date of his patent, and thereunder. The defendants in this case are his rivals and

competitors in business, and at the date of the commencement of this litigation were carrying on their business of engine building at the city of Erie, Pennsylvania.

The particular type of engines manufactured by both parties litigant are what are known as "electric lighting engines"; such engines being used for generating primarily, and controlling the electric lighting circuits now in common use, principally under the incandescent lamp system. It is urged in behalf of the appellant herein that his above Letters Patent are good and valid Letters Patent, and that the defendants have clearly, without license or authority or justification in law, appropriated such inventions by the employment, not only substantially, but almost exactly, of the specific and precise mechanisms represented by appellant's invention and expressed in his claim. At the circuit below, the court decided that the patent was invalid and dismissed the bill for want of equity. (Rec., 16.) The opinion of his Honor, Judge Blodgett, giving his reasons therefor, is found in this record, beginning page 12. The questions raised by the record and insisted upon in the trial of the case below, and which we suppose will be urged upon this appeal, although not recognized, except in a single instance, by the decision of the learned Judge, are:

First. As to the validity of the patent sued upon, this question arising under appellee's answer, wherein it is denied that the appellant was the original and first inventor of the devices patented, and wherein it is asserted that the alleged patented inventions were in public use and on sale in this country for more than two years prior to the date of application for said Letters Patent, being the only defense recognized by Judge Blodgett in his opinion.

Second. As to the proper construction to be given to the single claim of the patent; this question arising under the patent, the pleadings and also under the testimony.

Third. As to whether or not defendants have infringed said patent; this question also arising under the pleadings, admissions and testimony.

Assignment of Errors.

The appellant assigns and claims as error on this appeal as follows:

1. That the court erred in holding that said Letters Patent were invalid, and that the bill should be dismissed for want of equity.

2. That the court erred in holding that the several alleged instances of prior exhibition and employment of the inventions of said letters patent, as set forth in said opinion, anticipated such inventions and was a public use thereof, in this: that it required no invention to produce the claimed devices of appellant's patent, in view of the asserted instances of the old governor employment, as identified by Judge Blodgett's opinion.

Appellant Ide's Invention—Construction of Patent.

A fairly comprehensive and concise statement of the invention of Mr. Ide is contained in his patent printed at the close of this brief, beginning with lines 12 to 74 on page 1 of the patent; such Ide patent also appearing in printed form in this record, beginning page 151; such statement being as follows:

" This invention relates to that class of steam engine " governors known as ' fly-wheel governors,' and has for " its primary object, to provide means for holding the " eccentric steadily in its proper poised position, in op- " position to the tendency of certain extraneous forces, " which are calculated to disturb the movements of the " valve, as sought to be determined by the balanced " forces of weights and springs, when the engine is in " motion.

" To this end, the invention consists in the combination " of a dash-pot with the governor and pulley, said dash- " pot connected with a fixed and movable part, or with " two relatively or unequally movable parts, as, for ex- " ample, with the extremity of a weight-lever and the " pulley-hub.

" In this class of governors, the position of the eccentric " is variably determined by the opposing and self-balanc- " ing forces exerted by the centripetally-acting spring " or springs, and the centrifugally-acting weight or " weights connected with said springs, the intention being " to hold the eccentric permanently in a certain poised " position for a given speed of the wheel to which the " governor is applied, and to vary the position of the ec- " centric exactly as the speed of said wheel is vaired. " There are, however, certain temporarily acting causes " of disturbance calculated to change the position of the " eccentric independently of the speed of the wheel. The " principal of these disturbing causes is the inertia of the " reciprocating parts, including the eccentric and the " parts actuated thereby; and a secondary cause is the " gravity of the eccentric when not counterbalanced by " some special device for the purpose. At a regular and " very high speed of the governor, wheel or pulley, these

"disturbing forces operate but slightly, owing to the mo-
"mentum of the weights, which serve to prevent their
"deflection from a regular course; but at a lower speed
"than that at which the apparatus is adjusted to run, and
"particularly in accelerating or retarding the engine, as
"in starting up or slowing down, these incidental disturb-
"ing forces interfere materially with the valve action and
"give an objectionable irregularity to the movements of
"the weights. In the case of an engine used for run-
"ning a dynamo for electric lighting purposes, and sub-
"ject to sudden and wide changes in requisitions of power
"and speed, the effects of the disturbances referred to
"manifest themselves also in the quality or intensity of
"the lights. A dash-pot constructed and attached to the
"apparatus in such a manner as to prevent sudden move-
"ments of the weight-levers, or of the eccentric, is found
"in practice to wholly overcome the defect indicated, and
"to give a desirable steadiness and regularity to the
"movements of the movable parts of the governor, as
"well as accuracy and reliability to the cut-off action of
"the valve." * * *

By the term "dash-pot" in the appended claim, "I
"mean the device technically known by that name—
"usually comprising a closed cylinder, a piston having a
"passage through or around it, and a fluid confined in
"the cylinder as shown—or its equivalent." The patent, however, does not specify and point out in its specification all of the resulting advantages which arise out of the practical application of the invention claimed, as shown by the testimony. This we do not understand to be necessary. The claim of the patent is as follows:

"IN A FLY-WHEEL GOVERNOR, THE COMBINATION WITH
"RELATIVELY MOVABLE PARTS, OF A DASH-POT, SUBSTAN-
"TIALLY AS DESCRIBED."

An analysis of the mechanism of this claim as a whole shows that it is composed of the following elements or component parts, three in number:

First. A fly-wheel.

Second. A governor with relatively movable parts.

Third. A dash-pot.

It will be seen that the mechanical structure represented and expressed by the above claim consists in the combination of a fly-wheel, a governor with its relatively movable parts and a dash-pot, it being absolutely essential in the formation of this combination that there be allied together as described by the specification, a fly-wheel, a governor, and a dash-pot, as a unit structure.

Mr. Ide's patent seems to be so plain upon its face that there can be no question as to the construction to be put upon its claim, but in the argument of the case below, it was contended that a fly-wheel was no part or element in the claim, and that a dash-pot placed in any other kind of a wheel or device at any point upon the shaft, combined with a governor with relatively movable parts, was the invention and device of appellant's patent, and it was contended by the defendant appellees below that no such construction could be given to this patent as to include a fly-wheel as an element of the combination claim. As to this position, it is our earnest contention that there is no good reason for its advancement or sustainment, and there is nothing in the opinion below that indicates its recognition or sanction by the court.

The specification of the Patent distinctly states, in speaking of and identifying the invention, as follows: "*To this end the invention consists in the combination of "a dash-pot with the governor and pulley, said dash-pot*

"*connected with a fixed and movable part*," *etc.* The "claim distinctly specifies as one of its elements a "fly-"wheel."

If there has been, or can be any stronger statement of the elements forming a combination, and their specific character, than that appearing in the above, we fail to recall the same. We, of course, are aware that in the specification the governor and dash-pot is spoken of as located in a "pulley" without the appellation fly-wheel connected therewith. To a mechanic skilled in the industry of engine building, especially "in the case of an "engine used for running a dynamo for electric lighting "purposes," as described in Mr. Ide's patent, the term "pulley" as therein shown and described can mean nothing less than a fly-wheel or fly-wheel pulley. As in all electric lighting engines and, indeed, in the most of engines, equipped with fly-wheels, the fly-wheel itself is utilized as a pulley-wheel; again, the particular characteristic of a fly-wheel, which identifies it from all other wheels or pulley constructions, is the diameter of the wheel and the metal in the rim. To mechanics skilled in the engine industry, the specification and drawings mean and can mean nothing else than the description and exhibition of a fly-wheel utilized as a pulley, as is fully proven in this record by appellants' witnesses and admitted by appellees. (Rec., 182, p. 38, C. Q.; p. 79, Ans. Q. 7; p. 117, Ans. Q. 5.)

This whole matter is tersely stated by appellant's witnesses, who in speaking of the evident fact of his patent exhibiting and meaning a fly-wheel and nothing else, says as follows:

"A. The relative size and proportions of the wheel and "shaft. The drawings represent the wheel as be-

"ing eleven times the diameter of the shaft. The "drawings also represent the rim of the wheel "as being one-half the thickness of the diameter "of the shaft and two times the diameter of the shaft in "width. Besides, the spokes represented are shown to "be as wide as the diameter of the shaft and their thick- "ness half the diameter of the shaft; therefore, being "four times stronger than would be required or is ever "used in a pulley for the transmission of power only. "Any mechanic would recognize it as a fly-wheel from "the drawings alone in view of these proportions. The "specifications and claim also designated it in positive "terms as a fly-wheel. The terms governor and pulley- "wheel used in the specifications simply imply that the "construction of wheel shown could be used for the "purpose of a pulley or driveing wheel." (Rec., 84, 85.)

Judge Blodgett clearly recognizes this construction of the patent claim in his opinion, where he says that "*the "claim of the patent is for putting this governor with "dash-pot into the fly-wheel of the engine.*" (Rec., p. 15.)

Therefore, in view of the expressed terms of Mr. Ide's patent, and the endorsing and explanatory testimony as to questions of usage and fact, we take it that there can be no doubt that the "fly-wheel," *per se*, is an element of the single claim of Mr. Ide's patent. The decisions of this court are uniform as to the generosity and liberality of construction which this court will give to patent grants as to their construction, for the sustainment thereof.

In the case of *Klein* v. *Russell*, 19 Wall., 466, this court, Mr. Justice SWAYNE, speaking, says, "The court "should proceed in a liberal spirit so as to sustain the "patent and the construction claimed by the patentee

" himself, if this can be done consistently with the lan-
" guage which he has employed.

" Patents are to be liberally construed."

Merrill v. *Yeoman*, 94 U. S., 568.

APPELEE'S INFRINGMENT OF CLAIM—PLAIN AND ADMITTED.

On the question of infringment this record shows that defendants admitted by a stipulation and agreed, that said detendants between the date of the granting of the patent Number 301, 720 and the date of the filing of the bill of complaint upon which this action is founded. " The de-
" fendants manufacture fly-wheel governors like ' Com-
" plainant's Exhibit Defendants Fly Wheel Governor '
" and embodied the same as a part of their engine con-
" struction, and used the same between the dates afore-
" said within the Northern district of Illinois." (Rec., 18.) Defendant appellees also admitted " that the dash-
" pot in defendant's construction is filled with oil or gly-
" cerine or similar non-compressible liquid." (Rec., 22.)

The testimony also shows that prior to Mr. Ide's invention, or the year 1884, the defendant's governing mechanism was a small light, loose pulley distinct from the fly-wheel, in which there was no dash-pot. (Rec. 79, Q's. 9, 10, 11.) And that after the year 1884 defendants "discarded their light pulley containing the governor and " substituted therefor a fly-wheel pulley, with governor "and dash-pot combined, substantially as shown in my " invention as to mechanism, purpose, object and result." (Rec. 79, Q. 12.)

Comparing now " Complainant's Exhibit Complainant's " Patent " with " Complainant's Exhibit Defendants' Fly-

"Wheel Governor," and running a parallel between the mechanisms of the two devices, we find it clearly apparent that this defendant's structure consists of a fly-wheel of precisely identical construction as that shown in complainant's patent, and having in combination therewith a governor practically identical in character and construction with the governor of complainant's patent, serving essentially all the purposes and offices of complainant's governor. We find also a dash-pot in combination with this fly-wheel and governor in defendants' device, substantially identical in construction and in purpose, adaptation and use with the dash-pot of complainant's patent. In fact, "Complainant's Exhibit Defendants' Fly-Wheel Governor," as a unit structure, is almost identical with the device of complainant's patent and accomplishes exactly and precisely the same functions, operations and results, the only difference being in minor details of the most trivial character, which relate to mere matters of convenience and in no wise affect results. In making this statement we have not overlooked the fact that in defendants' combination of fly-wheel governor and dash-pot, the dash-pot piston rod is throughout a portion of its length in the form of a coil or spring, between its point of attachment to the weight-lever and the dash-pot itself. This, however, cuts no figure in the operation of the dash-pot, and has no influence on any of its associate mechanisms. This interposed spring in the dash-pot piston rod represents a mere theory to the end or purpose of permitting a certain motion of elasticity or yielding effect in operating the piston of the dash-pot. This, however, is merely fanciful, and in practical operation the spring or coil in the piston has no beneficial effect whatever, for the reason that it is so

rigid that it has practically the same effect as the straight piston rod of complainant's patent; the fact being, as abundantly proven in this record, that if such spring possessed any elasticity or resiliency which would be noticeable in practical operation, such spring would destroy the entire efficacy of the dash-pot and governor, for the reason that it would cause them to flicker and dance, and thus negate their useful purpose. It is also in evidence and identified, that the spring of defendant's dash-pot piston is a disadvantage, in this, that it forms a weight at that point, and in high speed acts as a force to crowd the piston against the sides of the dash-pot, and thus interferes with its sensitiveness and best form of operative working. (Record, 42, 44, 126, 129, 145, 111.)

We therefore confidently assert that the claim of the Ide patent in suit, viz: "In a fly-wheel governor, the "combination with relatively movable parts of a dash-"pot, substantially as described," is as entirely and exactly applicable, and as entirely covers the defendant's device, as the device of the complainant's patent. It is a noticeable fact that while the defendants in their unsworn answer deny that they infringe this patent of complainants', *they took no proof to back up or support this assertion.* The defendant, Ball, himself, who is also an inventor, went upon the stand in his own behalf and did not deny it. (Record 195; Q. 1-6.) The proof as to the identity of structure between the defendants' structure of fly-wheel, governor and dash-pot, and the device of complainant's claim by witnesses of intelligence, and with full knowledge of both mechanisms, is ample to that end in complainant's record, pages 21 and 44.

There were two suggestions made at the oral argument in the case below upon the part of the defendants

counsel and re-asserted in the brief submitted, to the effect that the fact of infringement had not been clearly established for the reason that the fly-wheel character in defendants structure was not clearly proven and that the presence of an alleged coiled spring in defendants' dash-pot took defendants combination of fly wheel, dash-pot and governor out from under the claim of complainant's patent, or stated otherwise, prevent the claim from covering the same.

We do not take it that these suggestions, for they are suggestions only, effect the fact of defendant appellees' infringement of this claim. The defendants themselves admitted as above quoted the fly wheel character of their combination (Rec., 18), and the proof is abundant, and none otherwise, to the effect that complainant "Exhibit Defendants' Fly Wheel Governor" is a correct model of defendants devices and exhibits a fly wheel and dash-pot and governor combination identical therewith, not only as to construction, but as to operation and result. (Rec., 21–42 to 45, and 122.)

As to the presence of the coiled spring forming part of the piston of defendants dash-pot, there can be no other contention, we take it, than that such spring is merely supplemental to the dash-pot element of defendants device, but such addition can have no possible effect to controvert the fact of infringement.

Cochrane v. *Diener*, 94 U. S., 786.
Western Electric Co. v. *La Rue*, 139 U.S., 607.

It may serve no useful purpose to establish the fact, but the testimony clearly shows, that, if the coiled spring forming a portion of the piston rod of defendant's device,

had in it any yielding or resilient action in practical operation, it would destroy the value and utility of the device to the extent of such action and if such action was sufficient in its yielding or elasticity, the entire value of the defendants' device for any purpose would disappear. Under the above authorities, the fact that this coiled spring feature of defendants device, is protected by a patent, does not alter any condition, or the fact of infringement. It may be true that even if there is no proof in defendants record on the question of infringement, that it is within the province of the court to take up such question and of its own volition settle and pass on such fact, even if the finding as to such fact directly controverts the testimony of the complainant, but unless such case is so manifest as not to be effected by sworn testimony, we take it that this court will not see fit to determine such question adversely to the testimony of the record when the defendant appellees did not see fit to take any testimony as to the proven fact.

This court in an early case of *Bennett* v. *Fowler*, 8 Wall, 845 we take it, in substance so decides:

"The counsel also objects that the machines of the de-
"fendant do not infringe on the complainant's patent, but
"if he had intended to contest this point, he should have
"introduced proof to this effect. Proof of infringement
"given, that the machines made and used by defendants
"were substantially like the complainants, was sufficient
"if not rebutted."

Defendants' Infringement Wilful.

This is not a case where the defendants can shield themselves or appeal for sympathy on broad equities to the court on the ground of innocence, inadvertence, acci-

dent or mistake in the adoption of complainant's invention. The record in this case shows that prior to the last part of the year 1884, the year of appellant's patent, or first part of the year 1885, the defendants were manufacturing an engine with a *fly-wheel*, and a small governor pulley, separate therefrom on a shaft. (Rec., 197, Ans. C. Q. 17; p. 198, C. Q. 22.) This engine with its small governor pulley and *fly-wheel* is illustrated in defendants' catalogue. One of complainant's witnesses states the difference between "Complainant's Exhibit, Defendants' fly-"wheel governor" and the old governor device used by the defendants prior to the adoption of the invention of Ide, in this manner: "It had no dash-pot and it was on a loose "pulley." (Rec., 150, Ans. C. Q. 3.) The proof shows that the individual defendant, Mr. Ball, was present at St Louis, Missouri, at the Exposition, when all the principal engines of the United States were submitted to the severest tests, and where the superiority of the Ide engine over all others as to absolute steadiness and isochronism, was clearly demonstrated by reason of his invention, and that Mr. Ball saw such engine. And that after such date the defendants discarded their old small light governor pulley-wheel, substituting therefor a *fly-wheel*, and combined such *fly-wheel* with a governor and dash-pot, almost precisely identical with complainant's patented construction.

We respectfully contend that in view of the above facts, apparent, admitted and proven, appellant's patent, as so far presented, is good and valid, and the infringement by defendant appellees of the single claim thereof has been clearly established.

DEFENDANT APPELLEE'S ONLY DEFENSE—PRIOR USE.

We have thus first discussed and disposed of the second and third objections to Mr. Ide's patent as raised at the court below, but there unnoticed, and which we presume will again be asserted here, and we now turn to what is the strain of the case and at the circuit below was considered to be the only defense worthy of consideration in the opinion, namely, that the appellant Ide patent is invalid by reason of prior use thereof, not in the combination exhibited in appellant's patent, but so closely allied thereto as to rob such patent of any merit as to any exhibition of any invention; there being in this record no assertion or suggestion that Mr. Ide's invention had ever been disclosed or suggested in any prior patent or printed publication in this or any other country.

Briefly epitomized and as exhibited by the facts concerning which there is no dispute, this record shows that in the year 1880, and long prior thereto, the well-known corporation, The Buckeye Engine Company, of Salem, Ohio, one of the largest engine manufacturers in the United States, constructed engines in which the governing mechanism consisted of a hollow metal disk constructed in two or three parts and clamped upon a driving shaft, such disk when completed upon the shaft being about forty inches in diameter and weighing "*in the neighborhood of 200 pounds.*" (Rec., 182; C. Q. 41, 48, 52.) These disks or shells were utilized solely as a housing or base in which to build a governor as so testified to by defendant appellee's own witnesses. (Rec., 183; C. Q. 54.) The governor in such disk being equipped with arms arranged to swing by centrifugal force as the shaft revolved and connected with the

eccentric and kept from swinging too freely by springs acted upon centripetally. The proof is undisputed that the Buckeye Engine Company never built their engines with governors of any other form, construction or location than as indicated above, namely, in the metal disk or shell bolted upon the shaft. The testimony is undisputed also that in the years 1880, 1881 and 1882, at three points in the United States there were Buckeye engines that were unsatisfactory, defective and treacherous in their operations, namely, at the works of the Hartford Carpet Company, Thompsonville, Connecticut; at the Hartford Engineering Company, at Hartford, Connecticut; and at the Dow's Stores or Pacific Elevator at Brooklyn, New York. That the engines in these cases "raced", "ran irregularly" and threatened to wreck themselves. (Rec., 176, Ans. to Q. 18; 205 C. Q. 4; 193 C. Q. 26–30.) The metal disk on these shafts housing the governing devices had nothing to do with the fly-wheel and were entirely independent therefrom. (Rec., 205, C. Q. 3.) The fly-wheels on the Hartford engines were fourteen feet in diameter. (Rec., 181, C. Q. 35.) Each fly-wheel weighing 25,000 lbs. (Rec., 184, C. Q. 61.) The fly-wheels of the Carpet Company engines being sixteen feet in diameter and weighing approximately each 16,000 pounds. (Rec., 206, C. Q. 5.) The fly-wheels of the Brooklyn Dow's Store engines were eighteen feet in diameter and weighed eight tons of 2,000 pounds each. (Rec., 193, C. Q. 24, 25.)

All of these witnesses were witnesses for the defendant appellees and testified to what would appear as a matter of course, that these engines were perfectly worthless and inoperative without the presence of the fly-wheels, and that the metal disks had no suggestion of the fly-wheel

element in them and were placed about six feet from the fly-wheel. (Rec., 193, C. Q. 22.)

The testimony is to the effect that in the years 1881 and 1882, dash-pots were put into the governor casings of these Buckeye engines to prevent such engines from racing and wrecking themselves, and their application at that point for that purpose was satisfactory. (Rec., 204, Q. 1–12; p. 190, Q. 20–27.) These facts, as testified to by appellee's witnesses, are found in the depositions of Mr. Horace Tabor (Rec., 174), Mr. Edwin Schneider (Rec., 189), Mr. William Steele (Rec., 204).

Mr. Joseph W. Thompson was called by the defendants, and he is a mechanical engineer in the employ of the Buckeye Engine Company of Salem, Ohio. Mr. Thompson, on direct-examination, gave the impression that he knew of dash-pots being applied to some of the governors on the disks of the Buckeye Engine Company and produced a drawing to represent the same. (Rec., 166.) Cross-examination of this witness, however, showed that he never saw and did not know of his own knowledge personally, of any dash-pot ever having been applied to a Buckeye-engine governor. (Rec., 170, C. Q. 10, 11.) The understanding of the witness being that the dash-pot that was put on the Buckeye engines, was put on to make them practically operative. (C. Q. 14.)

Appellant called but one principal witness to testify by way of explanation and emphasis as to these old Buckeye engines and the above facts; such witness being Mr. William H. Hoffman, a mechanical engineer, who was personally familiar with the application of such dash-pots to these engines, and who superintended and directed the alteration and application of the dash-pot devices of some of these Buckeye engines. Mr. Hoffman's testimony be-

ing that the engines were radically defective in their operation and the dash-pots were put into the governor casing to prevent the engines from wrecking themselves, and to avoid suits for damages, and obtain payment therefor by the Buckeye company. (Rec., 55. 71.)

The above testimony of appellees when analyzed makes prominent a number of facts that are relevant to the questions to be here determined.

We have as exhibits in this case wood-cuts, showing the Buckeye Company's engine as issued by them, and the size and relation of the relative parts, namely, of the fly-wheel and of the disk, showing the Buckeye governor as used in these old engines, and as manufactured and sold to the trade, to which we refer for a clear understanding and eye illustration of the facts as here contended for, and positions asserted, and the syllabus of such facts can be briefly stated as follows:

First. That the several dash-pots put in the Buckeye engines in the three instances identified, were put in by isolated individuals.

Second. That no dash-pot was ever put in a governor disk of a Buckeye engine by that company or its officers, or there appeared as a part of the governing mechanism, or construction in any engine as applied by the Buckeye Engine Company.

Third. That such dash-pots were applied in no other instances, except in the above few desperate cases where the engines were practically inoperative, and were only put on for the sole purpose of preventing the engine from wrecking itself, and to enable the Buckeye Engine Company to avoid suits for damages, and collect withheld payments upon such engines.

Fourth. That no governor, much less a dash-pot, was ever put in the fly-wheel of a Buckeye engine.

Fifth. That the small 200 pound detachable, sectionally-made governor casing of the Buckeye engine, had not in it the slightest element of a fly-wheel, such fly-wheels being of the weight of more than 25,000 pounds, and having a diameter of eighteen feet.

Sixth. That the small governor casing could not be utilized even for the purpose of a small pulley-wheel, because of its jointed sectional structure, its unstable connection with the main shaft, and the over-hanging protecting casing, all upon one side, forming its periphery.

Seventh. That a fly-wheel is as well defined a structure, with as well known characteristics which identify, as to office, size, proportion, *weight of metal in rim* and other characteristics, as any other distinctive part of an engine structure.

Judge Blodgett treated all these admitted differences between the old governor casings of the Buckeye disabled engine structures and the unit structure identified by the claim of appellant's patent as merely incidental and trivial, and as contended by appellant, either misunderstood the force of the record as made by appellant or failed to appreciate the vital difference between the two structures as clearly exhibited and shown by the testimony. Judge Blodgett in his opinion states as follows:

"The only feature in which these Buckeye governors "with the dash-pot can be differentiated from the com- "plainant's patent is that they were not placed in the fly- "wheel of the engine to which they were attached. Mr. "Ide has taken this Brooklyn and Thompsonville gover- "nor out of the shell or disk in which it was placed by

"the agents of the Buckeye Company on the shaft and "attached it to the hub and radial arms of the fly-wheel of his engine, and the claim of his patent is for putting "this governor with dash-pot into the fly-wheel of the "engine.

"The most he has done has been to fasten this old "Brooklyn and Thompsonville governor to the arms of "the fly or balance-wheel of his engine instead of "leaving it on the driving shaft where he found it, and "the only question is, has he invented anything in doing "this? I do not learn from the proof that any new func- "tion is obtained by the combination covered by this "claim; the governor still performs the same function and "no other than it did when fastened to the shaft by the shell "and arms as in the Brooklyn and Thompsonville gover- "nors, and the fly-wheel still performs the functions it "did before the governor was brought into it; their joint "operation when combined is the sum, and only that of "their seperate operation in the older machines.

"The patent, therefore, seems to me to come clearly "within the rule in *Ruckendorfer* v. *Faber*, 92 U. S., 354, "and *Pickering* v. *McCullough*, 104 U. S., 310. It is "true there may be some convenience in bringing these "parts together and making a more compact machine, "but that is a mere mechanical change which does not "rise in the realm of invention. As was said by Mr. "Justice MATTHEWS in the case last cited. 'In the patent- "able combinations of old elements, all the constituents "must so enter into it as that each qualifies every other. "* * * It must form either a new machine of a dis- "tinct character and function, or produce a result due to "the joint co-operating action of all the elements. It is "not a mere adding together of separate contribu ions.'

"For these reasons I am of opinion that the patent is "not valid and that the bill should be dismissed for want "of equity."

If Judge BLODGETT's statement is true, viz: that "The "only feature in which these Buckeye governors, with the "dash-pot, can be differentiated from the complainant's "patent is, that they were not placed in the fly-wheel of "the engines to which they were attached. * * * I "do not learn from the proof that any new function is ob- "tained by the combination covered by this claim," then we acquiesce in the justice of the conclusion, but upon the other hand, we earnestly contend otherwise, and contend that the combination ot Mr. Ide's claim comes clearly under the distinction pointed out by Mr. Justice Matthews as quoted from Judge Blodgett's opinion and it is earnestly contended that the combination of the single claim of Mr. Ide's patent is a patentable combination wherein all of the old elements enter into the combination so that each qualifies the other and so combined, form a new machine of distinct character and function and produce a result due to the joint co-operating action of all of the elements, and clearly that the combination of the Ide claim is not merely the adding together of separate contributions; the testimony clearly showing the error of conclusion of Judge Blodgett's decision of differentiating the mechanical combination of appellant's claim from the old devices of the three Buckeye engines. We most respectfully and earnestly contend that, as clearly exhibited by the proofs in this case, there is a marked and patentable difference in construction, operation and result, between the added devices in the governing case of these old Buckeye engines and the combination represented by the claim of appellant's patent, as made certain and exhibited by the

testimony of distinguished and intelligent witnesses in this case as follows.

William H. Hoffman, a witness called by the complainant, and as before stated, personally familiar and directing the applied dash-pot to the Buckeye engines at Hartford, we most earnestly insist, is a very high authority on this question. Mr. Hoffman is not a professional expert, but is much better qualified to state facts and express opinons as to this matter, than any mere expert, as he has in addition to all the qualifications of a stereotyped expert, a practical knowledge to confirm his opinion, as facts. Mr. Hoffman is, by profession, consulting engineer, has had charge of some of the principal locomotive engine works in the United States, is a member of the society of Mechanical Engineers, and is a contributor and referee upon nice questions of mechanical engineering to the American Machinist, the principal journal of this description in this country. (Rec., 29–31.)

At the risk of appearing tedious, we most respectfully petition this court to read that portion of the deposition of Mr. Hoffman here quoted where he, upon personal knowledge, compares the two devices:

"The advantages gained in discarding the old governor "disk, or casing, as made on the Hartford engines and "Buckeye engines, at Salem, and substituting therefor a "combined governor or fly-wheel pully are many, prin- "cipally among which are the increased diameter of the "structure, which enables us to place our weights at a "long distance from the center of the shaft, thus reducing "the weight of these weights and this reduces our inertia. "The arms can be longer and lighter if necessary; the "pin-journals are subjected to less wear as they are sup- "porting less weight. The springs can be longer, if de-

" sired, and the whole friction of the moving parts can be
" materially reduced where we have a large circle to work
" in. For instance, in making connections from the weight
" levers to the cut-off eccentric, the angles of these con-
" nections will be very moderate compared with those
" placed in a small governor casing, thus relieving the pins
" and journals of a large amount of frictional resistance,
" which is equivalent of course to the reduction of the in-
" ertia. Then, again, having a fly-wheel or fly-wheel
" pulley, as the structure to which we attach our moving
" mechanism of the governing device, we have absolute
" rigidity, so that as the weights move out with their
" centrifrugal force, and as the springs retard with a cen-
" tripetal force, and as all the connections are affected by
" centrifrugal force, such as this swaying of the springs,
" etc., they are prevented by the rigid structure, the
" fly-wheel, from being thrown from their true align-
" ment, and this again prevents a large amount of fric-
" tion, which is always present in the old style of disk or
" shaft-governors, where the mechanism is attached to a
" very light structure. Another great advantage in lo-
" cating the governing device in the fly-wheel or fly-
" wheel pulley, is that it is necessarily located next to the
" main bearing of the engine. The fly-wheel, placed at
" this point, becomes a receptacle for the initial shock
" caused by the steam when it is admitted to the cylinder.
" With the old arrangement, the governing disk or case
" was necessarily placed next to the main bearing, while
" the heavy fly-wheel was, by the nature of this arrange-
" ment, moved far away from this bearing, where it could
" play but little or no part, as an absorbent of the initial
" shock of the entering steam. This shock is entirely, or
" at least mostly removed from the main bearing of the

" engine at each dead center point, thereby reducing the " friction of the main journals from twelve to fifteen per " cent. As regards adjustment where the governing de- " vice is located in the fly-wheel pulley, the advantages " are obvious. As our inertia is so greatly depressed, " the adjusting-screw, sliding-blocks for springs, and all " dash-pot attachments can be materially reduced in size, " and the location of the dash-pot can be such that its " convenience of adjustment is materially increased and the " friction of the piston in its cylinder will be brought to " a minimum, especially that caused by its centrifugal " action in its revolution. Another point of gain is in " the economy of manufacturing, as the method of com- " bining the governing device with the fly-wheel or fly- " wheel pulley, gives us one piece less upon the shaft, " permits us to shorten the shaft, gives us a narrower " foundation, and consequently less ground space. This " will certainly represent a total saving of six per cent. in " the cost of the engine and its erection." (Rec., 39, 40, 41.)

Upon cross-examination, Mr. Hoffman had put to him a supposititious question, assuming that the old Hartford engine-governor casing device to be much more perfect in its construction and operation than it actually was. Mr. Hoffman, there being asked (Rec., C. Q. 78, p. 70) whether Mr. Ide would be entitled to claim broadly the combination of the *fly-wheel governor* and *dash-pot* with their relation to the movable parts, replied:

" I should say that even in view and face of all of the " alleged facts enumerated by you in your question, that " he was entitled to a patent for an invention of a very " high order, as he was the first to form and invent the " new combination of the fly-wheel, governor and dash-

" pot combined as a unit, for this combination gives as " near absolute perfection and regulation as is possible to " obtain, and nearer perfect regulation than any other de- " vice heretofore invented, and has been and is of incalcu- " lable value in all the electric-lighting systems."

Mr. Albert L. Ide. The complainant is a skilled and educated mechanical engineer and practical engine builder, and was for many years familiar with the Buckeye engine and the Buckeye governor, and took pains to familiarize himself thoroughly with the few defective Buckeye engines with inserted dash-pots, appearing in this record. Mr. Ide ought to know what his invention is, and ought to know its difference and distinction from these defective Buckeye engines, and Mr. Ide does know such differences, and itemized and in detail clearly pointed them out in his deposition.

" I am familiar with the Buckeye-engine governors as " manufactured by the Buckeye Engine Company, of " Salem, Ohio, and as also manufactured by the Hartford " and Manilla Company, and the model " Exhibit B " does " not correctly represent any Buckeye engine governor " that I have ever seen, and to my positive knowledge " does not correctly represent the Buckeye governors on " the Hartford Carpet Company or the Hartford Manilla " Company or any cut in any Buckeye engine catalogue " that I have ever seen. My reasons are as follows: " *First.* It does not correctly represent the proportions " of any governor that I have ever seen that was built by " the Buckeye Company or the Hartford Engineering " Company, because the diameter of the pulley portion " of the governor, as represented by the model is twelve " times the diameter of the shaft on which the governor " is placed, which is more than twice as large as was ever

" used. To correctly represent a Buckeye governor on a " shaft of the present model, the containing disk or pulley " should not exceed five inches in diameter instead of " twelve, and every other part of the governor is dis- " torted with respect to the shaft. The model also differs " from every Buckeye engine that I have ever seen, on " account of being mounted in a pulley wheel, such as is " ordinarily used for transmitting power instead of their " ordinary containing disk with offset rim. The flange or " rim of the pulley on this model extends equally on both " sides of the spokes, and the hub on the sides of the " pulley extends out a considerable distance beyond the rim, " while in the Buckeye governors, as formerly manufact- " ured, the flange or casing to protect the parts of the " governor projected only on one side and the hub por- " tion of this disk projected only a short distance be- " yond the end of the disk. In their governors of more " recent construction they have cored holes through the " disk for giving free access to the other parts of the " governor, still retaining the offset construction of the " rim. I have been familiar with the Buckeye engine " governor for several years, having first seen their en- " gine running in the Centennial exposiiton in 1876, since " which time I have seen a large number of their engines " applied to various uses and have been called upon to " repair and adjust Buckeye engine governors and have " made new parts of the governors of both the Salem " and Hartford Engine Company's engines in my works.

" Q. 19. Would, or did the governor containing disks " of the Buckeye Engine Company, testified to by the " defendants' witnesses as having applied to them dash- " pots in the Hartford Carpet Company and the Manilla " Company's engines, contain, indicate, point out, or sug-

"gest in any manner, the inventions, combinations, and "devices set forth in your patent and covered by the "single claim thereof, and if not, why not?

"A. It did not contain my invention, and certainly did "not suggest it to the Buckeye Engine Company nor "anybody else, because they never adopted it, or never "even constructed an engine containing my invention. "Furthermore, in my opinion, it never could or would "suggest my invention to anybody. In the first place, it "is impossible to apply my invention to a disk or shaft "governor, as contained on these engines, for the reason, "first, that, owing to the manner in which these govern- "ors were constructed, it would be a mechanical impossi- "bility to obtain equilibrity of the weights and springs, "and this was impossible because the containing disk was "too small to locate weights in their proper position so as to "attach springs, which would directly oppose the centri- "fugal force of the weights without transmitting their "power through the pivots and bearings of the levers, "and on account of the disk being of small diameter ex- "tremely heavy weights were required, these weights on "the Hartford Carpet Company's engine weighing sev- "eral hundred pounds. This immense weight in itself "would prevent the prompt and quick action necessary "to produce an equilibrious and isochronous governor on "account of the action of gravity affecting the steady "action of the governor at each revolution. Another "reason why it is a mechanical impossibility to make an "isochronous and equilibrious governor as constructed "on the Hartford Engine Company, and which, there- "fore, does not suggest my invention is, because it is a "mechanical impossibility to construct a spring that will "vary in strength in the exact proportion as the resist-

" ance varies while the eccentric is being revolved on the
" shaft. In this Bukeye disk governor, the application of
" centrifugal force to revolve the cut-off eccentric is pecu-
" liar, the connecting links being so attached to the lugs
" of the eccentric that a relatively great force is required
" to revolve the eccentric when the weights are nearest
" the shaft. After the weights have moved out about
" half their distance, their leverage on the eccentic is
" largely increased, enabling them to move the eccentric
" with less centrifugal force, and when the weights are
" moved still further out, the lugs are revolved to such
" position as to require an increase of centrifugal force.
" Therefore, in order to balance the weights in equipoise
" and produce an equilibrious governor, it would be neces-
" sary to use a spring that would give its greatest re-
" sistance when partially extended, or one which is a
" mechanical impossibility. Another difficulty in the way
" why said Buckeye governor did not suggest
" my invention and would not contain it is, be-
" cause equilibrity, equilibrium and isochronism cannot
" be obtained on account of the excessive friction
" that was always present in these governors and
" was occasioned by their heavy weights spring-
" ing the light supporting disk, thus straining the joints
" and bearings out of line and causing increased internal
" friction. Owing to these defects, it would have been
" impracticable and dangerous to have attempted to run
" a governor of that description at the high speed neces-
" sary, to furnish a steady power, such as is required for
" driving electric lights. Another reason why these
" Buckeye disk-governors would not suggest and did not
" contain my invention is because, owing to the small
" diameter of the disk, it was impossible to locate a dash-

" pot of proper design so as to produce the results ob-
" tained in my invention or in such a manner as to ensure
" the successful operation of an equilibrious governor.
" This is because the dash-pot must be placed with the
" chamber radially with the shaft, so that the piston will
" travel in the lines of centrifugal force, thus preventing
" friction or binding of the parts. A dash-pot located as
" shown by 'Defendants' Model of Buckeye Engine Gov-
" ernor' would utterly defeat the objects of my invention
" and especially if so applied to a high-speed engine, as
" the centrifugal force when the engine is running would
" act on the dash-pot and its piston-rod and spring them
" out of line and cause them to bind and prevent the
" prompt and sensitive action of an equilibrious governor,
" and thus wholly defeat the object of my invention. As
" seen by 'Defendants' Model of the Buckeye Engine
" Governor,' the dash-pot is supported pivotally at one
" end, the piston-rod being supported pivotally at the
" opposite end. When the engine is running and the
" governor in operation the piston rod is extended, mak-
" ing a long distance between the points of support. The
" centrifugal force, acting sideways on the dash-pot, will
" cause the parts to bind and the stuffing box to leak, and
" thus defeat the successful and sensitive action
" necessary to my engine, and that is contained in
" my fly-wheel governor. Another reason why
" this Buckeye engine disk governor with dash-
" pot did not and could not contain my invention is
" because the weighs were necessarily confined to a
" range of movement near the shaft, which not only ne-
" cessitates great weight of the balls, but also occasions
" wide difference of centrifugal force upon the balls at
" their outer and inner extreme positions. In my fly-

" wheel governor mechanism all of these defects are elimi-
" nated and overcome, as, for example, the fly-wheel
" forms a rigid and unyielding base, on which to support
" the structure and working parts of the governor. The
" large diameter of this wheel permits the use of longer
" levers which are fulcrumed on pivots at a greater
" distance from the shaft and further from their ends,
" thereby allowing the use of longer connecting rods,
" which will move in nearly direct lines, or straight lines,
" both moving in the same direction (instead of pulling
" in opposite directions, as shown in the model of Buck-
" eye engine governor), thus avoiding acute angles and
" consequent friction and unequal transmission of the
" forces or power of the weights and springs in the rotat-
" ing or shifting movements of the eccentric. By locat-
" ing the levers a greater distance from the shaft I avoid
" friction, and overcome one of the inherent and radical
" defects, which is in all governors with weights located
" near the shaft. Another advantage gained by the
" combination of the fly-wheel governor and dash-pot
" is permitting the weights to be located at a greater
" distance from the shaft, which causes them to travel
" at a high rate of speed, producing greater power
" and effect, thereby permitting the use of very
" much smaller and lighter weights, thereby over-
" coming to a great extent the evil effects of
" gravitation and inertia, and reducing the friction of the
" pivotal bearings to the minimum. The light weights
" and reduced friction permits the quick and sensitive
" action absolutely necessary to obtain an equilibrious and
" isochronous governor like that shown and described by
" my patent.

" Another advantage obtained by my combination of

" of the fly-wheel governor and dash-pot, is that it af-
" fords ample room to permit the use of springs of suffici-
" ent length and size, and permits their proper location
" in the fly-wheel, governor and dash-pot, so their resist-
" ance, when being extended, will increase in the same
" relative proportions as the forces of the weights in-
" crease in their outer movement, this permitting the ad-
" justment of the springs at their full theoretical initial
" tension, which condition is necessary to maintain equil-
" brium of the forces of the weights and springs in all po-
" sitions of the weights in their outer and inner move-
" ments without causing any perceptible variation or
" change in the speed of the engine, thus making a truly
" equilibrious governor. Another advantage gained by
" the combination of the fly-wheel, governor and dash-
" pot, is, it permits the best location of the dash-pot of
" the best proportions to be attached at or near the free
" end of one or both of the levers where the travel is the
" greatest, and where the dash-pot has the greatest ef-
" fect, and for this reason may be made of smaller diam-
" eter and be placed lengthwise in a direct radial line
" from the shaft, or parallel with the spokes of the wheel,
" so the piston will travel in the direct line of centrifugal
" force, in which position it will be free to move without
" friction of parts, and when in this position, the glycerine
" or oil, is by centrifugal force kept in the dash-pot, and
" not thrown from the stuffing-box. Under these condi-
" tions, the dash-pot will give the steady and controlling
" effect which is absolutely necessary to insure the practi-
" cal and successful operation of an equilbrious governor.
" Therefore, by the combination of the fly-wheel, gov-
" ernor and dash-pot, as described by the specifications,
" drawings and claims, of my patented fly-wheel gov-

" ernor, and by the proper construction, location and ar-
" rangement of the parts, as described and shown by such
" a combination of a fly-wheel, governor and dash-pot
" combined in one piece of mechanism which act together
" in harmony as a unit, and produce and accomplish new
" and valuable results which never were and never could
" be accomplished by any device or combination before
" in use.

" Q. 20. From your knowlege of the Buckeye en-
" gines, what defects existed which at all times tended
" to render them dangerous or destructive to the engines
" themselves?

" A. The inherent defects in all Buckeye engine gov-
" ernors was locating excessively heavy weights near the
" shaft, and connecting the weight levers to the eccentric
" in such a manner that it required a much greater force
" to start the eccentric in its rotary motion around the
" shaft than would be required to rotate the eccentric
" when in its intermediate or natural working condition.
" For this reason it was necessary to adjust the springs
" at a tension very much below their full theoretical initial
" tension, in order that their resistance would not prevent
" the weights from leaving their initial position until the
" engine had attained a speed considerably beyond the
" normal speed at which it was designed to run. On ac-
" count of this apparently necessary slack adjustment of
" the springs in their initial position in starting the engine
" before it had attained its normal speed, the action of
" gravity on the heavy weights and the resistance of the
" unbalanced engine-valve and friction of the stuffing-
" box, all of which had a tendency to alternately force the
" weights back and forth from their initial position, thus
" causing the weights to vibrate and pound against the

"eccentric to such an extent that there was danger of "breaking of the parts. This vibrating and pounding "action of the weights would also frequently be set up "when a sudden change of load occurred on the engine. "This pounding action also occurred in shutting the en- "gines down. This vibrating or pounding of the weights "was always liable to occur, and it was a well-recog- "nized defect in the construction of the Buckeye engines, "and was liable to occur at any time under a sudden "change of load, or if the lubrication of the valve ceased "and the friction became excessive on either valve or "stuffing-box, or both. These defects were not so ap- "parent in some engines as in others, but, in my opinion, "were greatly aggravated and more troublesome in the "engines of the Hartford Carpet Company and Hartford "Manilla Company, on account of the low rate of speed "at which these engines were run; and, in my opinion, "the dash-pots were put on these engines for the sole "purpose of preventing the slamming and pounding ac- "tion of the weights due to these inherent defects named, "and was not put on for the purpose of improving the "regulation of the engines."

The deposition of Mr. Ide upon this point might, perhaps, be comprised in smaller compass, but the very carefulness and pains taken by Mr. Ide in pointing out such differences, and emphasizing them, of necessity strengthened his statements and analysis; and we again most earnestly and urgently ask this court to carefully consider this sworn statement of Mr. Ide's, as it was given, under the firm and honest belief of its correctness and truthfulness in every respect.

Mr. M. E. Dayton, an expert witness, whose depositions have often appeared in the records of this court, carefully

examined these old Buckeye governor structures with their applied dash-pots, and also minutely points out the differences, both as to function, structure and results, between the Ide invention and the old device. The deposition appearing in Rec., 18–29, 115–131, sets forth and agrees with all the above statements and propositions, Mr. Dayton's conclusion being, viz: "The conclusion following, that the introduction of the dash-pots into these old "unbalanced governors did not make the combination "and invention, and did not produce the structure or results set forth in the Ide patent sued upon."

Summary.

The principal resulting advantages of the *fly-wheel governor* and *dash-pot* of the Ide claim over the few old governor disks of the defective Buckeye engines with inserted dash-pots, when summarized and analyzed, briefly, are as follows, advantages both as to construction, purpose and result:

First. The great diameter of the fly-wheel and its overhanging rim as a protecting casing.

Second. The solidity of the *fly-wheel* as a base and element of the combination which permits the *governor* and *dash-pot* to be revolved therein at a high rate of speed, not permissible by any such structure as the two sectionally bolted and jointed, detachably connected and keyed *governor* casings, to the Buckeye engine's shaft.

Third. The distance with which all parts of the *governor* and *dash-pot* can be placed from the shafting; thus reducing their weight and size to the smallest capacity, lengthening the springs, etc., and in this manner *reducing to a minimum the friction of all the parts*, and securing

immediate and spontaneous action of all the parts; for the reason that only the minimum of inertia is to be overcome. The valve action from this construction and result, being simply perfection, and producing the equilibrious and isochronous movement never heretofore obtained, or considered possible, and absolutely impossible in the Buckeye engine, because a mechanical impossibility as there constructed.

Fourth. The introduction of the *fly-wheel* as an element in the Ide claim of *fly-wheel, governor* and *dash-pot*, permits an alignment practically of the entire device, with the valve, at a point on the shaft located next to the main bearing of the engine, which is most highly desirable, as the *fly-wheel, governor* and *dash-pot* at that point received the initial shock of the steam entering the cylinder, and reduces the friction in the main journal from twelve to eighteen per cent., as shown by the proof. This construction is impossible if the old Buckeye engine governing disk is used, as such disk must practically usurp the space occupation of the fly-wheel combination of the Ide invention.

Fifth. The added economy of construction which consists in eliminating the old governor disk from the shaft, thus dispensing with this extra piece of mechanism, and permits the shaft to be shortened in every instance to the extent of the space occupied by this governor disk and its overhanging rim.

Sixth. Another economical advantage in the Ide combination of *fly-wheel, governor* and *dash-pot*, is the bringing of all these parts in one structure and under the reach and operation of the automatic oiling arrangements which are from necessity placed on or near the main bearing of the engine.

The proof in this record, overwhelmingly establishes the fact that all of the above advantages of structure and result, reside in the combination of the Ide invention; and it would seem that these resulting advantages of structure and result, either allied or singly, would be sufficient, upon which to found patentability, or invention, and it would seem that the learned judge below could not have carefully read or considered the proof, or he would not have made the statement appearing in his opinion.

Isochronism.

We most respectfully urge your Honor not to dismiss the proof as to the isochronous and equilibrious character of the Ide invention, from this record in the cavalier and flippant manner in which this subject is treated by defendants' counsel. The isochronism and equilibrity as present in this Ide invention, are not high sounding or trick words put in this record to catch the ear or give false impression as to the meaning or scope of the resulting structure herein contended for. They are the only words which correctly represent the facts and express the character of the results obtained, and we here quote from the record the statement of the conditions and results expressed by these words in connection with the Ide invention; which show the truth and importance of their use and application to the invention. (Rec., 85; Ans. Q. 22.) "Equilibrity is a balanced condition "of the centrifugal force of the weight and centripetal "force of the springs. Equilibrium means that the "weights and springs are in this balanced condition, and "an equilibrious governor is one in which, when running, "these forces remain balanced while the weights are in

"all positions from their initial or innermost position to "their ultimate or extreme outer position."

"*An isochronous governor is one which will cause the "engine to make the same number of revolutions per "minute, regardless of the change of load or work which "may be thrown on or off the engine. It will also count "the same or make the same number of revolutions per "minute with the weights in any position in their range "of movement. Isochronism is the result of equilibrity in "a governor when the equilibrity is made possible. By my "invention I have for the first time in the history of this "art, made equilibrity of the governor practical, and "isochronism or isochronous action, possible and certain.*"

The few old defective Buckeye engine governors and their governor castings with inserted dash-pots, did not and simply could not, produce or insure equilibrity, much less isochronism.

The Great Practical and Commercial Success of the Ide Invention showing Patentability.

The testimony in this case shows that the complainant, Albert L. Ide, for twenty years prior to the production of his invention in 1884, was an engine builder, with his works at Springfield, Illinois, a most unsatisfactory locality geographically, for carrying on any manufacturing business, and especially a business of this character. That the invention had its origin with Mr. Ide in the study of electric lighting systems where a steam engine is principally used as the power to run the dynamos and operate the light circuit. Mr. Ide visited all the engine works in the United States, familiarized himself with the experiments made by Thomas A. Edison, the inventor, at Menlo Park, and himself spent large sums of money in the con-

struction of several engines, with unsatisfactory results, the final result being the invention or discovery represented by the claim of the patent in suit, such invention being so absolutely perfect and acceptable, that when embodied in an engine running 1,000 lights, enables you to switch off instantaneously, 500 of them, the invention controlling the engine so perfectly that " no fluctuating or " variation in brilliancy would be perceptible in the lamps " being driven by the same engine." (Rec., 72-77.)

A great commercial advantage to users of incandescent lights accrued at once, by reason of this Ide invention, and is found in the fact that such lamps cost about one dollar each, and are composed of a glass bulb from which the air has been exhausted, containing a light loop of carbon filament hermetically sealed. The greatest destructive element to this filament is the varying degree of the electric current passed through it, and its life and the life of the lamp is usually something over 600 hours, with comparatively steady power, and with unsteady power from 300 to 500 hours. Mr. Ide's invention lengthens the life of these lamps to over one thousand hours average, and many of his lamps are giving service of over 2,000 hours. (Rec., 22 and 23.)

Of course the destruction of the filament is the destruction of the lamp. The effect of the Ide invention on Mr. Ide's business was as instantaneous and marked as the effect on the lamps. Mr. Ide states that " my busi- " ness has increased to a wonderful extent. I find it im- " possible to supply the increased demand for these en- " gines at my factory in Springfield." Mr. Ide has licensed the Harrisburg Manufacturing Company, of Harrisburg, Pennsylvania, the invention being the basis of the license and contract; that company working between one and

two thousand men, such company having sold several hundred engines containing his invention. Mr. Ide "is now "building a large addition to his works, to increase his "capacity one hundred per cent," his invention also being the basis of a contract with the Union Iron Works of San Francisco, California, and "they are now building my "engines extensively and placing them in the immense "government vessels and war ships now being built by "them for the government and shipped to foreign coun-"tries." The Union Iron Works are the largest and most complete iron-works in the United States. Mr. Ide further having agencies in all of the principal cities between Harrisburg and San Francisco for selling his engines, and stating that every engine built by him contains his invention, and every one has given entire satisfaction (Rec., 78.)

We here quote at length from the testimony of Mr. Ide, showing his struggles, experiments, failures and trials before he solved the problem as shown by the invention of his patent.

"I continued to build this class of engines for a great "variety of purposes, until the year 1870, at which time "I erected works of my own at Springfield, Illinois, and "known as the Ide Engine Works. I continued to build "throttling-governing engines with the fly-ball type of "governors described, until about the year 1880, in these "works. At about this time my attention was called to "the experiments being made by Thomas A. Edison, at "Menlo Park, for the perfection and introduction of in-"candescent electric lights. I went to Menlo Park to "satisfy myself personally in regard to the probable suc-"cess and commercial introduction of electric lighting. "When I first saw the lights, I noticed an unsteadiness

"and objectionable pulsation and variation of the intensity "of the lights, and in a personal interview with Mr. Edi- "son, he informed me that this pulsation was occasioned "by the unsteadiness of the power derived from the engine. "We went into the engine-room, and I examined the "engine. It was a Corliss engine, built, I think, by "George H. Corliss, of Providence, Rhode Island, who "had the reputation of building the best and most per- "fect regulating engine known at that date, and Mr. Edi- "son informed me that he had purchased one of the "Corliss engines, and had it made especially for his use, "because he believed it to be the best engine then made "for giving the steady power required for driving electric "lights. Each revolution of the engine could be counted by "looking at the electric lights, some of which were sev- "eral hundred feet from the engine in use in lighting the "the park. Mr. Edison stated that the governing "and regulation of this engine was not satisfac- "tory, and that a better governing and regulat- "ing device for engines would be necessary before he "could obtain a steady and satisfactory commercial "electric light. This information and investigation turned "my mind in the direction of inventing or perfecting an "engine suitable for electric lighting use, and one by "which the difficulty referred to would be overcome. "About one year from this time, I purchased and placed "in my works a Thompson & Houston ten-light dynamo "with ten lamps for furnishing lights in the merchants' "stores in Springfield, and this dynamo was driven from "the throttle-governed engine which was driving the "machinery in my works. These lights were not satis- "factory on account of their unsteadiness, and Mr. Thomp- "son, of the Thompson & Houston Electric Light Com-

" pany, came to Springfield with a view of remedying the
" defect which caused the unsteadiness of the lights, and
" he informed me that this unsteadiness was caused by
" by the unsteadiness or irregular speed of the engine
" which was driving the lights. About one year from
" this time, or about the spring of 1881, I made up my
" mind that electric lighting would be a success and would
" come into general use for illuminating purposes, provid-
" ing an engine or power could be obtained which would
" give the steadiness of power necessary to produce a
" satisfactory commercial light. I went to New York
" and investigated the different systems of electric light-
" ing then being introduced, and decided to take the
" western agency for the Fuller-Wood system of electric
" lights. I also informed myself in regard to the most
" suitable engine then being manufactured for the purpose
" of driving electric lights, being satisfied that the engine
" I was then building was not suitable for this use;
" such leading engines then thought most desirable for
" driving electric lights was the Armington & Sims, then
" built at Lawrence, Massachusetts, and formerly known as
" the Lawrence engine, the Porter-Allen engine built by the
" Southwark Foundry and Machine Company at Philadel-
" phia, and the Hampson engine, sold by Edward Hampson
" at 34 Cortland street, New York; these engines all being
" of the type known as high speed automatic engines.
" On farther investigation, I found the engine called the
" Hampson was being manufactured by W. B. Payne &
" Sons, then of Corning, New York. I investigated this
" engine and selected it as being as suitable as any engine
" then built for this use, and gave Payne & Sons an order
" for several engines to be used for driving electric lights
" of the Fuller system, which I was then introducing in

" the west, having my principal store room on Washing-
" ton street in Chicago. These engines had their gov-
" ernor in a light pulley-wheel on the shaft. I sold and
" placed a number of these engines in store buildings in
" Chicago, for the purpose of driving electric lights of the
" Fuller and other systems, and they did not prove satis-
" factory, on account of their unsteady motion and irreg-
" ular speed. On this account and for this reason I then
" decided to design and construct an automatic engine of
" superior design and construction if possible, in order to
" obtain a steady, reliable and satisfactory power for driv-
" ing electric lights. I then sold out my electric lighting
" business in Chicago, and devoted my whole time and
" attention in designing, constructing, experimenting with
" and perfecting a high-speed automatic engine that
" would fill the requirements for electric lighting pur-
" poses. For this purpose I designed and constructed an
" engine with the fly-wheel and governor combined.
" This fly-wheel also was designed to act as a driving
" wheel or pulley to transmit power, and was of the most
" perfect design of fly-wheel and governor combined,
" both as to form and workmanship. After a series of
" thorough and exhaustive tests and trials, I found this
" governor was not satisfactory, and would not give the
" perfect regulation and steadiness of power and speed
" required for driving or furnishing perfect and satisfac-
" tory electric lights. These being the best engines that
" could then be obtained, I placed two of them of eighty
" horse-power each in an electric light station at Spring-
" field, Illinois, run under my own observation. The
" regulation of these engines did not prove satisfactory, on
" account of the irregular speeds, causing a variation in
" the intensity of the lights and causing an unsatisfactory
" action in the lamps.

"I then saw that it would be necessary to provide some "means whereby the perfect regulation necessary could "be obtained. In the design and construction of this fly- "wheel governor, I made a wide departure in the form "and location of parts from any governor then in use, "with a view of overcoming the radical defects known "to exist in all other governors, these defects consisting "principally in excessive friction on the bearings of the "working parts of the governor, when the engine was in "motion, and this friction was so excessive on high speed "engines, as to make it utterly impossible to adjust the "governor, so as to obtain a quick and sensitive action "under changes of load, and at the same time maintain a "uniform speed of the engines. After testing my new "combination or construction of fly-wheel and governor, "I found it to be the most perfect governing mechanism "which has been produced. It was susceptible of being "adjusted in equipoise or in perfect equilibrium of the "forces while the engine was in motion. It was sensitive, "acting quickly and responding quickly to a sudden "change of load, this result being obtained by locating the "weights and springs in direct line, so one would pull di- "rectly against the other, thus relieving the pivotal bear- "ings from all strain. After perfecting this equilibrious fly- "wheel-governor, I found it impossible to obtain isoch- "ronism by its use, and that the engines would not run "at a regular speed, or at a given number of revolutions "per minute, at all times and under all conditions. It "then occurred to me that perfect isochronism could be "obtained by a combination of a governor, fly-wheel and "dash-pot, the fly-wheel being of sufficient size and "solidity to permit the relation and association of these "parts in one piece of mechanism to produce this result.

"I then made the combination of the fly-wheel, governor "and dash-pot, and it produced the most perfect regula- "tion I had ever known, and its performance exceeded "my most sanguine expectations, in every respect. With "this combination, I found it possible and practical to ad- "just the governors in perfect equilibrium, making it a "perfect isochronous governor, which kept the engines "under perfect control, causing them to make the same "number of revolutions per minute, under all changes of "load and varying steam pressures, without jumping or "vibrating, when heavy loads were suddenly thrown on "and off. On finding this combination produced these "excellent and valuable results, I believed I had made a "great and valuable invention or discovery, especially as "applied to the perfection of electric lighting, and deter- "mined to apply for a patent therefor, as shown by my "patent in suit. Upon further testing this new gover- "nor, I found it would maintain a perfect isochronous "movement of the engine under extreme changes of the "load, a result never before accomplished in any kind of "engine, to my knowledge and belief. I also found, by "experiment, that engines controlled by this new govern- "ing mechanism would produce a constant, steady power, "and run the dynamos at a regular speed, and produce a "perfectly steady, incandescent light, without any per- "ceptible variation in brilliancy, even when the engine "was placed under the most trying conditions, as, for "instance, when the engine was running 1,000 lights and "500 of the lights would be switched on and off instan- "taneously. Under these conditions, this new governor "would control the engine so perfectly that no fluctua- "tion would be perceptible in the other lamps being "driven by the same engine." (Rec., 74.)

Mr. Frederick Sargent, a mechanical engineer of Chicago and superintendent for several years past of the Chicago Edison Company and the Western Edison Light Company, covering the states of Illinois, Wisconsin and Iowa, testified that "his companies have used probably "every prominent type of engine manufactured in the "United States." (Rec., 148, Q. 14.) And that "since "using the first Ide engine and having the points of "merit brought before our notice, and from the good "results obtained, we have recommended them and used "them ever since, as being the best engine for our busi-"ness." (Rec., 147, Q. 9.) Mr. Sargent being called upon to locate the element of structure in the Ide engine which caused its adoption over the Ball and all others, stated that, "The principal point in the construction of "the Ide invention which makes it so favorable to us, is "the fine construction of the *fly-wheel and governor in "combination with the dash-pot*, which we find gives more "uniform speed and closer regulations under all conditions "of varying load and steam pressure, than any engine we "have had experience with." (Rec., 147, Q. 10.) Mr. Sargent stating that he had tested a forty horse power Ide engine "in throwing off the full load of the engine "suddenly * * * and found the variation to be only "one per cent." Mr. Sargent also giving in detail the manner and cause of the value of this Ide invention in electric lighting engines.

Mr. Frederick W. Horne, western manager for Excelsior Electric Company, and for seven years familiar with engines for electric lighting, testified that one of the most serious problems presented was the unsteadiness of the light arising from the varying current caused by the difference in the speed of the dynamo; that he was familiar

with the Ide engine with the invention in suit, since its production, and "has used more of his make of engines "than any other style in connection with our plants" * * * and "I believe it to be the best of any we have "had experience with." Mr. Horne, in giving the facts upon which he based this statement, at once attributed this perfection "to his *fly-wheel* governor, which gives us "the regulation, composed of the *fly-wheel governor and* "*dash-pot*, all combined to produce this steadiness of mo-"tion." (Rec., 132, Q. 8 and 9.)

Mr. Charles E. Jones, of St. Louis, Missouri, forty-seven years of age, a mechanical engineer of long and high standing and now a professor of this art at Washington University, St. Louis, Missouri (Rec., 133), states that he has "for the past twenty years been frequently called "upon to examine and test the various engines used "in service, both as to economy and their regulations. "* * * During my experience the past twenty "years in this capacity, I have examined and tested "upwards of more than 100 of these engines, and now "have on record tests and trials of more than fifty of such "engines" (page 134). Mr. Jones says that he was called upon by General Schaler Smith to test the various engines exhibited and employed at the general exposition in St. Louis, Missouri, in October, 1884, the principal engines in the country then being tested and exhibited, among which was the old engine of the defendants. Mr. Jones then gives in detail the test made of all these engines at that exposition (Rec., 134-136), and states the result as follows:

"*The above record will show that the Ide engine was the* "*only one engaged in this test that gave absolutely perfect* "*regulation under all conditions of varying loads. This*

" *was conclusively determined in this case of the Ide en-*
" *gine by the attachment of a tachometer, the indicator of*
" *which did show that there was no variation, this instru-*
" *ment being the most delicate and sensitive known for this*
" *purpose.*"

Mr. Jones was then asked, " To what did you attribute " this perfection and regularity of the speed and uniform- " ity of the Ide engine, testified to at the exposition?" to which he replied: " *To the combination of the* FLY-WHEEL, " *governor and dash-pot in one piece of mechanism.*" (Rec., 136; Q., 7 and 8.)

Mr. Jones stating further that he never, in his twenty years' experience in examining and testing the different engines of the country, had met the regulation in steadiness of the Ide engine, and attributed the whole result to the invention of the Ide claim.

Mr. DeLorman T. Bronson, a practical engineer of Chicago, testified that he had run the engines of the principal manufactories of the United States for the last twenty-five years, among which was the Ball and Buckeye engines, and from a speed indicator " got the closest results " and regulations for the Ide engine," and considered always that " it was the governor, fly-wheel and dash-pot " that produced these results." (Rec., 150.)

Mr. Walter B. Pearson, a mechanical engineer and a general agent of the A. L. Ide engine, containing the invention at bar, in Chicago, states fully the advantages of the Ide engine; details the great number of such engines used in the principal buildings of Chicago. (Rec., 139, 140.)

Mr. Pearson stating:

" The plants are all giving satisfaction in every way, so " far as steadiness of movement in the engine and uniform

" brilliancy of the lights are concerned. The regulation " of the engine in each case is so perfect that no varia- " tion is detected in the speed by ordinary methods. " In several instances where a tachometer (the most " sensitive instrument known for this purpose) has been " attached to an engine, it has shown a variation of less " than one per cent. in any instance." (Rec., Q. 5; p. 142.)

Mr. Pearson going on to state that in many of the tests applied to the Ide engine, he has thrown fifty per cent. of the load, and upon several occasions the entire load, " *both* " *off and on the engine with a resulting change in speed of* " *less than one per cent.*"

Mr. Pearson, when asked to what he attributed the regularity and uniformity of movement in the Ide engine and the electrical currents in the circuit operated upon by said engines, stated: " To the combination of the fly- " wheel, governor and dash-pot, which overcomes the de- " fect in governor and fly-wheel, which produces these " irregularities in other engines." (Rec., 142; Q., 2 and 8.)

The above depositions comprises appellant's testimony in this record, showing the great value and efficiency of the Ide invention represented by the claim of the patent in suit. Such testimony could have been multiplied indefinitely throughout all parts of the country, but the fact is so apparent and uncontradicted, that it was not deemed necessary to cumulate further evidence upon this point.

The recent case in this court upon the barbed wire fence patent, now known as the Barbed Wire cases, reported in 143 U. S., 275, appears to be wholly in harmony with the contention here urged and the position taken. In that case, the old art approximated closely in

form, and precisely in purpose and result to the device of the Glidden patent presented for sustainment in that case. The only distinguishment between the old art recited by the Kelly patent and the Glidden patent or wire, resided in the fact that the barbs of the Kelly patent were formed of flat pieces of metal, diamond shape, and strung upon a wire by a central hole, whereas the Glidden barb was formed of a short piece of coiled barb wire, the coils forming a hole in the middle, the same as Kelly; both barbs appeared in the completed constructiod of Kelly and Glidden in connection with twisted wires. This court, speaking of these differences between the Kelly and Glidden barbed wires in reference to the question of patentability says: "The difference between the Kelly fence "and the Glidden fence is not a radical one, but slight as "it may seem to be, it was apparently this which made "the barbed wire fence a practical and commercial suc-"cess." The court further speaking says: "The sales "of the Kelly patent never seem to have exceeded three "thousand tons per annum, while plaintiff's manufacture "and sale of the Glidden device (substituting a sharp barb "for a blunt one), rose rapidly from fifty tons in 1874 to for-"ty-four thousand tons in 1886, while those of its licensees "in 1887, reached the enormous amount of one hundred "and seventy-three thousand tons." The court further saying that "under such circumstances courts have not "been reluctant to sustain a patent to the man who has "taken the final step which has turned a failure into a suc-"cess." And that "in the law of patents, it is the last "step that wins." And that, "there are many instances "in the reported decisions of this court, where a monop-"oly has been sustained in favor of the last of a series of "inventors, all of whom were groping to attain a cer-

" tain result, which only the last of the number seemed " able to grasp."

We respectfully suggest that the above authorities are immediately in line with the question of patentability here discussed, and that they are not inconsistant with the uniform rules of decision of this court; and we respectfully submit that in view of the proven facts the elimination of the old separate mechanism for securing and housing the govenors of the Buckeye engine, admitting the application thereto in the three emergency instances of applied dash-pots; and the utilization of the fly-wheel combined with the governor and dash-pot, expressed by the Ide claim, exhibits decided invention and discloses unquestioned patentability, and especially is this fact emphaized and made certain, when we consider that by the testimony, such combination and organization of fly-wheel, governor and dash-pot, produces results impossible of production by the old instances of alleged prior use in the Buckeye engine structures, and that the combination of Mr. Ide's claim has solved the secret of the practical introduction and adoption of the electric lighting system of this country, and has gone into use to the exclusion of all other forms of governing devices upon steam engines, where desired results are to be made certain and maintained, as shown by the testimony in this entire record.

The testimony all shows that the defendant appellees were as swift to appropriate the inventions of this patent and abandon their old form of governor constructions as the appellant, when the knowledge of appellant's invention was brought to their attention. The testimony being that prior to the year 1884, the defendant, appellees' governing device was contained in a loose pully without a dash-pot (Rec., 150; C. Q. 3), and that immediately

after the year 1884, defendant appellees adopted the precise combination of the claim of the patent in suit, and and have used the same ever since. (Rec., 79; Q. 9.)

The illustrated diagram appearing in defendant appellees' circular showing the increase in their business of engine building since the year 1885, containing complainant appellant's invention, exhibits a ratio of increase in such business equal, at least, to that identified by appellant's testimony.

THE BEARING OF ALL THESE FACTS, UNDER THE DECISIONS, AS DEMONSTRATING PATENTABILITY.

We take it to be the well settled law of the land, touching this question of patentability, that the patentability of a machine or process may be established by showing that the machine or process has been so organized or evolved as to eliminate from the machine, a part in its organization heretofore considered essential, and do the work with a less number of parts, or may eliminate from the old process, one step, still accomplishing the same results, and that such re-construction of a machine or re-casting of a process with an omitted element or step, may involve invention of a very high order, especially when the new machine or process exhibits a new or a higher proficiency of result. Take for example, the case in this court of *Lawther* v. *Hamilton*, 124 U. S., 1, where the patent was sustained for a process of extracting oil from oleaginous seeds, and the omitted thing, which this court declared to be invention in the new process, by reason of its omission, consisted in the old process, of passing the crushed seeds under muller stones. The court at the Circuit decided that this omission in the old process, while a useful improvement, did not constitute invention in the eye of

the law. This court, however, reversed the decree of the court below, and speaking through Mr. Justice BRADLEY, thus gives the reasons therefor:

"If, as that court says, and we think rightly says, the "omission of the muller stones is a real improvement in "the process of obtaining the oil from the flaxseed; if it "produces more oil and better oil cakes, and it is new, "and was not used before, why is it not a patentable "discovery?" and that "He (the patentee) found that by "altogether omitting one of the steps of the former pro-"cess—the grinding and mixing under the muller stones "— and mixing in the mixing machine by means of "steam, a great improvement is effected in the result." And that "Why should it be doubted that such a dis-"covery is patentable? It is highly useful, and it is "shown by the evidence to have been the result of 'care-"ful and long continued experiments, and the application "of much ingenuity."

Again, take for example as a type of that line of cases that have been held to display invention in mechanical constructions by reason of the omission therefrom of old devices or parts heretofore considered essential, the carefully considered case at the Circuit by Judge Shipman, of *Manufacturing Co.* v. *Sargeant*, 28 Fed. Rep., 185. In that case Judge Shipman readily found invention and patentability to reside in the machine and patent, for the reason that in reconstructing or reorganizing the machine there was dispensed with some of its parts, the remaining parts to do the work of the original machine as successfully as before its reconstruction, Judge Shipman basing his reason for finding patentability probably upon the fact that the patentee's machine was a success commercially, was much simpler than the old machine, composed of a

less number of parts, and much more readily and easily taken care of and cleaned.

Again, in the case of *Winans* v. *Denmead*, 15 How., 330, this court, speaking through Mr. Justice Curtis, stated that "merely to change the form of a machine is "the work of a constructor, not an inventor." but such change introduced a new mode of operation, and "thus "attained new and useful results, is the subject of a "patent."

In the case of *Morey* v. *Lockwood*, 8 Wall, 230, this court sustained the device as an invention where the only change from the old art was the change or substitution of an entire soft rubber bulb in the device, where such soft rubber bulb had been used before with metallic heads, such change introducing far more useful results, and making in every way a far superior article of manufacture commercially.

In conclusion, your Honors, we most respectfully contend that Mr. Ide is entitled to a most liberal interpretation of his invention, and entitled to hold the defendants to the strictest account for their acts and doings. These defendants are skilled engine builders of long standing, and the individual defendants herein, by their own testimony, inventors in the same line of steam-engine governing mechanism as Mr. Ide. These defendants abandoned their old inventions and governor devices immediately after the appearance and introduction to the trade by Mr. Ide of the inventions of his patent, and the practical demonstrations of its value, and appropriated Mr. Ide's invention, and incorporated it into their engine building in almost the exact form disclosed by Mr. Ide's patent. They did it openly, they admit, and they did it defiantly, and they defend and justify their action under these three old

instances of applied dash-pots to the rickety engines of the Buckeye company; and now proclaim that they do so under these facts as a right. We are here to contest that right, and we are before this last great court to adjudicate between the appellants and appellees as to such right. With that judgment, whatever it is, we must and shall be content.

Respectfully submitted.

C. K. Offield.

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IN THE

United States Supreme Court,

October Term, 1892.

Term No. 227. **Case No. 13,836.**

ALBERT L. IDE,
Appellant, Complainant below,

vs.

THE BALL ENGINE CO., FRANK H. BALL, JAMES McBRIER AND P. S. KINGSLAND.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ILLINOIS.

BRIEF FOR APPELLEE BALL.

J. K. HALLOCK,
For Appellee Ball.

J. D. GALLAGHER,
Of Counsel.

The Evening Post Job Printing House, New York.

IN THE

Supreme Court of the United States.

October Term, 1892.

TERM NO. 227. CASE NO. 13,836.

ALBERT L. IDE, Appellant,
Complainant Below,

vs.

THE BALL ENGINE CO., F. N. BALL, JAMES MCBRIER and P. S. KINGSLAND.

Appeal from the Circuit Court of the United States for the Northern District of Illinois.

Statement.

The bill of complaint on which this cause is founded charged infringement by the defendants below, the appellees, of two certain patents issued to the complainant, A. L. Ide, namely, No. 301,720, dated July 8, 1884, for a Steam Engine Governor, and No. 308,498, dated November 25, 1884, for a Steam Engine Governor, which patents appear in the record beginning on page 152.

In the trial below the charge relative to the patent No. 308,498 was not pressed and the case rested wholly on patent No. 301,720.

The defense offered by the defendants was, (1)

invalidity of the said patent by reason of prior uses; (2) non-infringement by the defendants.

Judge Blodgett heard the case and delivered the opinion, which is found at page 13 of this record.

It will be seen by examining this opinion that Judge Blodgett found the first defense, namely, invalidity of the Ide patent, to be sufficient, and dismissed the bill without passing upon the second defense, the question of infringement.

From this decision and the resulting decree this appeal was taken.

The first question, therefore, that is at issue here is whether there was error in the finding below, and if it shall be found there was no error in the decree below that will, of course, end the case, but if, on the other hand, the decree shall be reversed, the second defense, that of infringement, yet remains to be considered, and may be considered by this tribunal we believe.

The Parties.

A. L. Ide, the complainant below and appellant, is a manufacturer of steam engines at Springfield, Illinois, which engines embody a series of inventions that have been patented by Mr. Ide, among which is the invention patented in the Letters Patent No. 301,720 at issue (see Record, beginning with x-Q. 1, p. 86). The type of engines made by Ide is generally spoken of as "automatic cut-off engines."

Of the defendants, the Ball Engine Company is a corporation under the laws of the Commonwealth of Pennsylvania, and is located at Erie in said Commonwealth; James McBrier is the president of the Ball Engine Company; F. H. Ball is a mechanical engineer and inventor, and was at the institution of this case an officer of the said Ball Engine Company, and

was the founder of that company; P. S. Kingsland was, at the institution of this case, the selling agent at Chicago of the said company. Practically the Ball Engine Company of Erie, Pa., is a builder of "automatic cut-off engines," and the engines complained of in the bill of complaint were built by it. These engines were built under and in accordance with certain Letters Patent issued to F. H. Ball, one of the defendants.

The Invention at Issue.

The invention at issue relates to the governing mechanism of "automatic cut-off engines," and to a clear understanding of it we should first fully understand the meaning of the various terms used in the patent, the evidence and the discussions. Some steam engines have no governing mechanism, but are governed or controlled wholly by manually operating the throttle. Locomotive engines, marine engines, &c., are samples of this class. Nearly all stationary engines are provided with governing mechanisms. They have a fly-wheel or balance-wheel to give steadiness of motion and to prevent the engine stopping on its crank centres, and they have means for regulating the supply of steam automatically from the speed of the engine. These means for automatically regulating the supply of steam are divided into two well-known types, namely, "throttle governors" and "automatic cut-off governors." A "throttle governor" is one that regulates the admission of steam to the valve-chest from the supply pipe by regulating the throttle-valve which is in the supply pipe. An "automatic cut-off governor" is one that regulates the admission of steam from the valve-chest to the cylinder by controlling the action of the valve or valves of the engine, and this regulation of the valves consists in changing the time of

cut off of the valve relatively to the rotation of the engine shaft or the travel of the piston.

Both these generic types of governors use rotating weights as the means for actuating the parts to be effected.

Automatic cut-off governors are divided into two distinct types, namely, those having the rotating weights mounted on a vertical shaft and those having the rotating weights mounted on the shaft of the engine. The former of these is exemplified in the Corliss type of engine, and in the record have been referred as fly-ball governors. The latter type is exemplified in the various engines illustrated in the exhibits printed in the record, such as the Buckeye engine, the Ide engine and the Ball engine, and is called by various names in the record, such as "wheel governors," "shaft governors," "fly-wheel governors," "shifting eccentric governors," &c. In the Patent Office this class or type is known as "shifting eccentric governors," and very properly so, because they all have one feature in common, namely, the weights in changing their position change the position of the eccentric, and thereby change the action of the valve moved by the eccentric. They are also very properly called "wheel governors," because they are always mounted in a wheel on the engine shaft; and they are with equal propriety called "shaft governors," for they are mounted on the shaft of the engine, and they are also properly called "fly-wheel governors," because they are generally built into one of the fly-wheels of the engine.

Whatever variation there is in the method of mounting this last named type of governor results from the form or style of the engine on which it is mounted.

If your Honors will look at the illustration of a

Buckeye engine in the print following page 162 of the record, you will see what is called a "side-crank" engine; and then if you will look at the print following page 216, you will see what is called a "centre crank" engine, or "self-contained" engine. It is called "self-contained" because all the parts are supported by one frame, while in the illustration of a "side-crank" you will see the far end of the shaft supported by an outside bearing or pillow block. In the illustration of the "side-crank" engine you will see a large wheel which is both a fly-wheel and a pulley wheel, as the driving belt is carried by it and it also contains the proper amount of metal to constitute it a fly-wheel or balance-wheel. You will also observe a small wheel within the large wheel apparently, although in fact it is not entirely so, but it is fixed upon the same main crank shaft. This small wheel is the governor-wheel and contains the governor. Now, if you will go back to the point, opposite page 216, you will see on each end of the engine shaft a large wheel, both of which are alike as to size and weight. Both of these wheels are fly-wheels and both are pulley-wheels, because it is intended that a driving-belt may run from each of them, and they jointly contain the proper amount of metal to balance and steady the motion of the engine. The governor is contained within the wheel that is in the foreground of the print, and you will see that the valve-chest of the engine is on that side of the engine. Now, opposite page 239 you will see another "self-contained" engine which is intended to use only one driving belt, and it has in the foreground a pulley with the governor in it and in the rear a fly-wheel or balance-wheel.

Then, again, opposite page 163 you will see a print showing a "side-crank" engine having two pulley wheels which also serve as fly-wheels or balance-wheels, and the governor is contained in the wheel in the front.

This is a Buckeye engine and it contains no special governor wheel as does the engine seen on the proceeding page.

All the governors shown in these prints are "shifting eccentric" governors, and they are all "shaft governors," and they are all "wheel governors" and three of them are in "fly-wheels." They are all the same class or type of governor which are most properly designated "shifting eccentric governors."

Following page 152 of the record and following page 154 are illustrations of the Ide governor, on page 163 is a cut of a Buckeye governor without a dash-pot, and following page 210 is an exhibit in which the application of a dash-pot to a Buckeye governor as it was made in 1881 is illustrated. A Ball governor is shown in the next exhibit and on page 220.

These governors are all of one type or class.

The Patent at Issue.

It is to this particular type of governor that the patent at issue relates.

The patentee says:

> "This invention relates to *that class* of steam engine governors *known* as '*fly-wheel governors*, and has for *its primary object* to provide means for *holding the eccentric steadily in its proper poised position*, in opposition to the tendency of certain extraneous forces which are calculated to disturb the movements of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion."
>
> "To this end the invention consists in the combination of *a dash-pot* with *the governor and pulley*, said dash-pot connected with a fixed and a movable part, or with two relatively un-

equally movable parts—as, for example, with the extremity of a weight-lever and *the pulley-hub.*"

"In *this class of governors* the position of the eccentric is variably determined by the opposing and self-balancing forces exerted by the centripetally acting spring or springs and the centrifugally acting weight or weights connected with said springs, the intention being to hold the eccentric permanently in a certain poised position for a given speed of the wheel to which the governor is applied and to vary the position of the eccentric exactly as the speed of *said wheel* is varied. There are, however, certain temporarily acting causes of disturbance calculated to change the position of the eccentric independently of the speed of *the wheel.* The principal of these disturbing causes is the inertia of the reciprocating parts, including the eccentric and the parts actuated thereby; and a secondary cause is the gravity of the eccentric when not counterbalanced by some special device for the purpose. At a regular and very high speed of the *governor wheel* or *pulley* these disturbing forces operate but slightly, owing to the momentum of the weights which serve to prevent their deflection from a regular course, but at lower speeds than that at which the apparatus is adjusted to run, and particularly in accelerating or retarding the engine, as in starting up or slowing down, the incidental disturbing forces interfere materially with the valve action and give an objectionable irregularity of movement of the weights. In the case of an engine used for running a dynamo for electric lighting purposes, and subject to sudden and wide changes in requisition of power and speed, the effects of the disturbances referred to manifest themselves also in the quality

> or intensity of the lights. A *dash-pot* constructed and *attached to the apparatus* in such a manner as to *prevent sudden movements of the weight-levers or of the eccentric* is found in practice to wholly overcome the defects indicated, and to give a desirable steadiness and regularity to the movements of the movable parts of the governor as well as accuracy and reliability of the cut-off valve."

From the foregoing it is clear that the patentee considered that there was a class of governors known as "fly-wheel governors," and that governors of that class were mounted in the "wheel," "pulley," or "governor-wheel" of the engine, and that in governors of that class there are certain disturbing causes which tend to deflect the weight-arms or the eccentric from its proper poised position, and that a *dash-pot* constructed and attached to the *apparatus* in such a manner as to prevent sudden movements of the weights, levers, &c., will overcome the defect.

That this patent, No. 301,720, was intended simply to cover the *application* of a *dash pot* to the type or class of governors represented in the drawings, and nothing more, is clear from the following statement in the other patent named in the bill of complaint, viz.: No. 308,498: (We quote from page 156 of the record, the last clause.)

> "The several parts of the governor hereinbefore described are constructed and operate substantially in the manner set forth in the application for Letters Patent of the United States before referred to as made by me on the 11th day of July, 1883, and now pending. Such parts do not, however, *with the exception of the dash-pot* hereinbefore referred to, form the subject matter of claims in said application, THE PARTS OF THE GOVERNOR BEING CONSIDERED NEW BEING CLAIMED HEREIN."

This makes it clear that the patent in contest, viz.: 301,720, is for the application of a *dash-pot* to the mechanism claimed in the companion patent (No. 308,498) or governors of that class; and that whatever excellence the Ide governor may possess as it is built cannot be attributed solely to the application of a dash-pot to a *fly-wheel governor*.

And there is certainly nothing in the statement of invention in the dash-pot patent (No. 301,720) that indicates any intention on the part of the patentee to limit his invention solely to governors that are in *fly-wheels* as contradistinguished from governors of the same class that are in *other wheels* on the shaft of the engine, for he uses the words "fly-wheel," "governor-wheel," "pulley," "wheel" and "apparatus" as equivalent terms, and refers to "*fly-wheel governors*" as a well known type or class of governors, and in the Patent No. 308,498 he give an excellent definition of what he means by a fly-wheel governor, as follows:

> "This invention relates to steam engine governors known as fly-wheel governors, or those which comprise a laterally movable eccentric upon the crank shaft of the engine and centrifugally acting weights operating in connection with centripetally acting springs to vary the position of said eccentric so as to regulate the movements of the valve and thereby produce a uniform speed in the engine."

This is an exact definition of the class of governors which is known to mechanics generally as "shaft governors," and in the classification list of the Patent Office as "shifting eccentric governors."

Our object in thus trying to clearly define the subject matter of the patent at issue is on account of the strain that the complainant now puts upon his patent to try and contract it into sufficiently small

compass to avoid the prior uses that have been so clearly proved that the complainant has admitted their existence, and bases his whole argument on an attempt to show that his patent may be sustained in a very shriveled and contracted condition in spite of the said prior uses. Their contention is what the complainant's counsel, in his brief below, was pleased to call the "strain of the case" in one of his headings.

THE ADMITTED PRIOR USES.

We do not deem it necessary to rehearse the proofs of prior uses put in by defendants, because they are so conclusive that the complainant does not attempt to dispute them. He simply says, in effect: Yes, it is true that some time before I made my invention *dash-pots* were used in *wheel governors* on Buckeye engines in Dow's Stores, or Pacific Elevator, in Brooklyn, New York, and at the Hartford Carpet Company's works, at Thompsonville, Ct., and at the Hartford Manilla Campany's Works, at Burnside, Ct., but these governors were in "governor wheels" and not in "fly-wheels," and hence they do not anticipate my patent. It is true these dash-pots were used in Buckeye "governor-wheel" governors, were applied to the relatively movable parts of the governor for the purpose of preventing "sudden movements of the weights and eccentric;" and it is true that the construction of the Buckeye governors on which these dash-pots were used was such that they comprised—

> "a laterally movable eccentric upon the crank shaft of the engine and centrifugally acting weights operating in connection with centripeally acting springs to vary the position of said eccentric so as to regulate the movements of the valve, and thereby produce a uniform of speed of the engine"—

but they were not in the *fly-wheel* of the engine but in a *governor-wheel* or *casing*, and hence they were not "*fly-wheel*" governors. It is true, as admitted by Mr. Ide in answer to x-Q. 15, on page 89 of the record, that Ide was not the first to put *in* the *fly-wheel* of an engine a governor such as Ide defined to be a fly-wheel governor in his several patents, but he was the first to make the combination of a *fly-wheel* a *governor* and a *dash-pot;* and while it is true we do do pretend to say that the *dash-pot* itself acts any differently in a governor that is in a *fly wheel* from what it does when in a governor *in any other wheel*, nevertheless Ide made a new combination of a *fly-wheel*, a *governor* and a *dash-pot*, and by so doing he is entitled to the sum of the advantages of such an assemblage.

That we are not overdrawing matters, but are stating the "strain of the case" fairly, we ask your Honors to read the following "summary" which we quote without any change whatsoever from the brief for complainants used in the trial below. But we ask your Honors to keep in mind the fact that Ide admits he was not the designer of a governor in a *fly-wheel*, and that as a matter of fact such a construction was very common.

Summary.

The principal resulting advantages of the *fly-wheel governor* and *dash-pot* of the Ide claim over the few old governor disks of the defective Buckey engines with inserted dash-pots, when summarized and analyzed, briefly, are as follows:

FIRST.—The great diameter of the fly-wheel and its overhanging rim as a protecting casing.

SECOND.--The solidity of the *fly-wheel* as a base and element of the combination which permits the *governor* and *dash-pot* to be revolved therein at a high rate of speed, not permissible by any such structure as the two sectionally bolted and jointed, detachably connected and keyed *governor* casings to the Buckey engine's shaft.

THIRD.—The distance with which all parts of the *governor* and *dash-pot* can be placed from the shafting; thus reducing their weight and size to the smallest capacity, lengthening the springs, &c., and in this manner *reducing to a minimum the friction of all the parts*, and securing immediate and spontaneous action of all the parts, for the reason that only the minimum of inertia is to be overcome. The valve action being from this construction and result, being simply perfection, and producing the equilibrious and isochronous movement never heretofore obtained or considered possibly, and absolutely impossible in the Buckey engine, become a mechanical impossibility as then constructed.

FOURTH.—The introduction of the *fly-wheel* as an element in the Ide claim of *fly-wheel, governor* and *dash-pot,* permits an alignment practically of the entire device with the valve, at a point on the shaft located next to the main bearing of the engine, which is most highly desirable, as the *fly wheel*, *governor* and *dash-pot* at that point receives the initial shock of the steam entering the cylinder, and reduces the friction in the main journal from twelve to eighteen per cent., as shown by the proof. This construction is impossible if the old Buckeye engine governing disk is used, as such disk must

practically usurp the space occupation of the fly-wheel combination of the Ide invention.

FIFTH.—The added economy of construction which consists in eliminating the old governor disk from the shaft, thus dispensing with this extra piece of mechanism, and permits the shaft to be shortened in every instance to the extent of the space occupied by this governor disk and its overhanging rim.

SIXTH.—Another economical advantage in the Ide combination of a *fly-wheel*, *governor* and *dash-pot*, is the bringing of all these parts in one structure and under the reach and operation of the automatic oiling arrangements which are from necessity placed on or near the main bearing of the engine.

Let us analyze the assumed advantages of construction that are set forth in this summary, in view of the fact that governors in fly-wheels were old.

FIRST.—The *diameter* of the wheel is the same since as before the adding of the dash-pot.

SECOND.—The *solidity* of the fly-wheel was not changed when the dash-pot was added, and the governor was not *revolved* any more rapidly after the dash-pot was added than before.

THIRD.—Since the diameter of the fly-wheel was not changed when the dash-pot was added, "*the distance* WITH *which all parts of the governor and dash-pot can be placed* FROM *the shafting*" was not changed by the adding of the dash-pot.

FOURTH.—We are, we admit, unable to see how the "introduction of the fly-wheel *as an element* in the Ide CLAIM * * * permits an alignment practically of the entire device," &c. We, of course, have no difficulty in seeing how the introduction of the governor into the fly-wheel or pulley-wheel of an engine permits the alignment of the governor and fly-wheel with the valve. But this was old before Ide added the dash-pot to the fly-wheel governor. The adding of the dash-pot to the fly-wheel governor did not bring the governor and fly-wheel into alignment with the valve. In all self-contained engines there is always a wheel at each end of the shaft, and the governor has always been put into one of these wheels.

FIFTH.—If Ide had been the first to put the governor in the fly-wheel or pulley-wheel and dispense with a separate governor-wheel there might be some force to the *fifth* clause, but, as he confessedly was not, there is not only no force in the *fifth* clause, but the essence of nonsense.

SIXTH.—In the Buckeye governors, to which the dash-pot was added, all the parts were in one structure, and in the old fly-wheel governors (using the term in a limited sense) all the parts except the dash-pot were in one structure.

It is worthy of notice that not one of the six alleged advantages above stated were named in the patent nor in the complainant's *prima facie* case. They are all new-born ideas, brought forward for the first time in the rebuttal proofs, and not one of them is attributed, or attributable to the adding of a dash-pot to the old and well known governor in a fly-wheel. Every one of them is the result of putting a governor in a fly-wheel or in a pulley-wheel, and this Ide admits was not new with him.

Hence, Judge Blodgett was fully warranted in saying he found no proof on which he could base patentability.

At the risk of arguing a point beyond the point of conviction, we will present an exact parallel case relating to a mechanism with which your Honors are perhaps more familiar than with steam engine governors.

You are all familiar with the dash-pots commonly used on doors to prevent them from slamming. You are also familiar with the Pullman vestibuled palace cars, and with the common unvestibuled cars, and with the Miller platform and automatic couplers that ore used both on vestibuled and unvestibuled cars. Now, let us suppose that the anti-slamming dash-pots had been used on the doors of the unvestibuled cars, and some bright, teeming-brained inventor should obtain a patent with a claim like this:

In a vestibuled train of cars, the combination, with the relatively movable parts of the doors, of a dash-pot, substantially as described.

And then suppose he should bring suit on his patent and the defendant should establish the fact that such dash-pots had been used on the doors of unvestibuled cars, and that then, in rebuttal, the complainant should take hundreds of pages of proof to show that vestibuled cars possess immense advantage over unvestibuled cars, and his attorney should come here and solemnly argue to you that the patent should be sustained because vestibuled cars had become very popular, and insist that the patent was for the combination of a vestibule, an automatic coupler and a dash-pot on the door of the car, and that a new result was produced because the dash-pot and the automatic coupler were covered over and housed in by the vestibule, while in the common old cars with dash-pots on the doors there was no covering over by the vestibule.

This supposed case is no more preposterous than the present one. It is an exact parallel.

Such was the "strain of the case" that was presented by the complainant in the Court below, and it was against such nonsense that Judge Blodgett decided.

JUDGE BLODGETT'S DECISION.

After rehearsing the specification and claim of the patent and the proofs of prior use admitted to be true, the learned Judge says (Record, page 15):

> "The dash-pots attached to these Buckeye governors were connected with a movable and a fixed part of the governor in such a manner as to be accurately described by the specification of complainant's patent. In other words, the structure of these Buckeye governors with the dash-pot added was such as to make them a manifest and palpable infringement of the complainant's patent if they had been made and used after instead of before the patent."
>
> "The only feature in which these Buckeye governors with the dash-spot added can be differentiated from the complainant's patent is that they were not placed in the fly-wheel of the engines to which they were attached. Mr. Ide has taken this Brooklyn and Thompsonville governor out of the shell or disk in which it was placed by the agents of the Buckeye Company on the shaft, and attached it to the hub and radial arms of the fly-wheel of his engine, and the claim of his patent is for putting this governor with dash-pot into the fly-wheel of the engine."
>
> "The most he has done has been to fasten this old Brooklyn and Thompsonville governor to the arms of the fly or balance wheel of his engine instead of leaving it on the driving shaft

where he found it, and the only question is, has he invented anything in doing this? I do not learn from the proof that any new function is obtained by the combination covered by this claim. The governor still performs the same function and no other that it did when fastened to the shaft by the shell and arms as in the Brooklyn and Thompsonville governor (Buckeye), and the fly-wheel still performs the function it did before the governor was brought into it; their joint operation when combined is the sum, and only that, of their separate operation in the older machines."

"The patent, therefore, seems to me to come clearly within the rule in Ruckendorfer *vs.* Faber, 92 U. S., 354, and Pickering *vs.* McCullough, 104 U. S., 310. It is true there may be some convenience in bringing these parts together and making a more compact machine, but this is a mere mechanical change which does not rise into the realm of invention. As was said by Mr. Justice Matthews in the case last cited: 'In the patentable combination of old elements all the constituents must so enter into it as that each qualifies the other. * * * It must form either a new machine of distinct character and function or produce a result due to the joint co-operating action of all the elements. It is not a mere adding together of separate contributions.' For these reasons I am of the opinion that the patent is not valid and that the bill should be dismissed for want of equity."

The learned Judge has stated the case with extreme liberality to the complainant, because he has treated the matter as if Ide was the first to place a

governor of this class in the fly-wheel or balance-wheel of the engine, and he has treated the claim of the patent as if it was for the combination with a fly-wheel of a governor having a dash pot therein, while he might have gone farther.

Judge Blodgett took great pains to fully inform himself as to this class of engines and asked to see various engines. He was taken into the basement of the Palmer House in Chicago, and there shown a Buckeye engine used to drive the dynamos that light the house. He was taken into the basement of one of the great theatres of Chicago and shown an engine there used for electric lighting. He was shown an Ide engine at the Edison electric light station, and he was shown a Ball engine. Judge Blodgett's great knowledge of mechanics enabled him to understand the case perfectly, and he could not be deceived by the chaff contained in the rebutting proofs.

Was there Error?

There certainly can be no claim that the learned Judge has erred in his understanding of the law. If he has erred at all, it must be in finding the facts to be as stated by him, for certainly it will not be contended that if the facts are, as stated by the Court below, the judgment should yet be reversed. To insist on such a contention would be asking this Court to reverse a whole line of its decisions and to completely change the fundamental doctrine of the law of patents.

In addition to the cases cited by the Court below, we will cite only the following:

Brown v. *Piper*, 91 U. S., 37.
Phillips vs. *Detroit*, 111 U. S., 67.
Smith vs. *Nichols*, 21 Wall., 112.

The law is clear, and the cases cited by the Court below fully exemplify it; the only contention there can be is as to whether the facts are as stated, and this we have fully discussed.

Alleged Commercial Success of Ide's Invention.

In the trial below much stress was given by the complainant's counsel to certain rebuttal testimony intended to show that Ide's alleged invention was recognized as a great improvement by purchasers of steam engines, and much law was cited to show that such proofs are to be taken as evidence of invention.

We do not deny that where there is doubt as to the patentability of an alleged improvement, evidence of its acceptance by the public as an improvement will have great weight, but certainly such evidence must be of the most positive character, and it must be a case of *doubt*. Such evidence cannot be of any effect in a clear case of double use like this.

If it had been clearly shown here that placing the governor in the fly-wheel was new with Ide and that thereby a clearly recognized new result was obtained; or that the placing of a dash-pot in a governor when located in a fly-wheel produced a clearly recognized new result that it did not produce when placed in a governor that was mounted in a governor-wheel simply, then such evidence might tip the scales in favor of the patent, but there is nothing of this in this case.

But, if there were such grounds, it would yet be necessary that it appear that the patentee's prosperity was attributable *solely* to the alleged improvement, and this prerequisite is wholly lacking here.

The proofs in this case show that before Ide became a patentee of improvements in steam engines

he was manufacturing old styled, slow speed, throttle governing engines at Springfield, Ill. That when the development of the electric lighting business throughout the country created a great demand for high speed, automatic cut-off engines, Mr. Ide entered the field as a builder of that class of engines.

Any one at all familiar with this trade knows that its development all over the country has been phenomenal. Everybody engaged in it has waxed fat, and there are now a score of builders of such engines where but a few years ago there was one.

It appears from the evidence (see page 86 of the Record, Ide as witness, x-Q. 1 *et seq.*) that Mr. Ide has patented a number of different improvements, *all of which* are incorporated in his "superior" engines. So, then, in view of all this, who can be able to say that Ide's prosperity is attributable to the placing of a dash-pot in a governor that is in a fly-wheel?

The complainant's rebutting proofs are filled with testimony that is mere bosh and nonsense. There is not one witness among them all who has not equivocated when asked to state clearly any new function or added effect due to the placing of a dash-pot in a governor—that is, in a fly-wheel—which is not also produced in a like governor when placed in a governor-wheel. It was impossible for them to state it, for it does not exist.

The dash-pot may be likened to a halter having an extensible strap, and it would certainly not be contended that it was a patentable invention to hitch a horse to an iron post with a halter having an extensible strap when it was old to hitch them with like straps to wooden posts, especially when it was also old to hitch horses with non-extensible straps to iron posts. At any rate, if such a claim was made it would be necessary to show that the extensible strap

performed some new office when connecting a horse to an iron post which it did not perform when connecting a horse to a wooden post.

Thus far we have quoted very little from the evidence, as it was unnecessary, as the proofs of prior uses were admitted to be true; and no surrebutting proofs were taken, as it seemed unnecessary to meet testimony that proves nothing. But we would be pleased, if the Court desires further enlightenment as to the matter at issue, to have it read the depositions of J. W. Thompson, page 166; Harris Tabor, page 174; Edwin H. Schneider, page 189; F. H. Ball, page 195; William Steel, page 204; Gardiner Sims, page 206.

Your Honors will have heard the Buckeye engine and the Armington & Sims engine referred to by the complainant as if they were a lot of old traps too antiquated to be considered. This is not so by any manner of means. These engines were long ago, and still are, considered to be standards of excellence. And we venture to say there are to day ten of each of these makes sold to one of the Ide engines.

The Question of Infringement.

We apprehend your Honors will have no difficulty in sustaining the decree of the Court below, but if you should not agree with the finding below we respectfully ask your Honors to consider the question of infringement before deciding to return the case.

The steam engines made and sold by the defendants contained the governor mechanism shown, described and claimed in Letters Patent No. 358,829 issued to Frank H. Ball, one of the defendants, on

March 8, 1887, for engine governing device, which patent will be found in the record, commencing page 210.

A reading of this Ball patent will show that the object, purpose and scope of Ball's invention is very different from those stated in Ide's patent 301,720. The dash-pot is used by Ide to prevent wide and sudden movements of the weights and eccentric when slowing down or starting up the engine. In Ball's device the dash-pot is used to provide a yielding base to an auxiliary spring *E*, and this spring is used to supplement the action of the main springs, and the reasons for its use are fully explained.

We come now to the question of infringement. We will discuss this question under two heads, as follows:

FIRST.—With the understanding that if the patent is sustained the claim must be limited to the use of a dash-pot in a fly-wheel governor in contradistinction to its use in other forms of wheel governors.

SECOND.—With the understanding that the claim be interpreted in the broadest possible sense, as if no prior use of a dash-pot had been shown in analogous governors.

If the first position is to be taken the defendants have not infringed, for it has been shown that they have never used a dash pot in a governor in a wheel which was a fly-wheel pure and simple.

The complainant's expert, Hoffman, and the complainant himself have insisted that no wheel is a fly-wheel that does not contain all the metal requisite to the full purpose of a fly-wheel disposed in said wheel in certain exact positions and proportions.

Here is part of what complainant has to say on this point:

"x-Q. 79. Please look at 'Complainant's Exhibit Complainant's Model,' and tell me how you adjust that governor, and when you make the adjustment? That is to say, whether you make the adjustment before or after the parts are assembled?

A. I make the adjustment after the parts are assembled by turning the screw which slides the block that holds the end of the spring, thus moving it nearer or farther from the hub of the pulley, the effect of which will be to cause the spring to stretch more when it is nearest the hub, or less when it is farthest from the hub during the outer movement of the weights. There is also a nut on the threaded eye-bolt, by which means the tension of the springs may be increased or diminished and by the combination of the two screws, the proper adjustment of the springs is conveniently and readily obtained. The method of adjustment is fully described in my patent for this device.

x-Q. 80. Is this adjustment made after the engine is completed and while on the testing block?

A. It is.

x-Q. 81. Supposing after the engine was tested and the governor adjusted to your satisfaction, you were to turn down the rim of the wheel, so that it was only an inch thick; would that necessitate any change in the adjustment of the governor?

A. It would not necessitate any change in the adjustment, but would probably spoil the successful operation of the governor.

x-Q. 82. Why?

A. Because the fly-wheel would then be too light to give a steady motion to the governor and engine.

x-Q. 83. But suppose that the engine upon which it was used had two wheels, one on each end of the shaft, as is common in self-contained engines, and the metal taken off this wheel was added to the other wheel, then what?

A. I never tried the experiment and don't know how of any one else ever trying such an experiment."

Here is a positive statement that no one to his knowledge ever put his governor in a pulley at one end of a shaft and a fly-wheel at the other end.

The Ball engine has a pulley with a governor in it at one end of the shaft and a fly-wheel of the same size as the pulley at the other end of the shaft, *and the complainant swears it does not contain his invention.* But to continue the quotation:

"x-Q. 84. In the governor of which we are just inquiring, what other or different function, if any, would the dash pot perform before the rim of the wheel is turned down to an inch in thickness that it will not perform after the rim is turned down?

A. After the rim is turned down, the whole operation and performance of the governor would be different, and the governor then would probably not be an isochronous governor because the reduced weight of the wheel would cause the wheel to vary in speed during each revolution of the engine, thus causing an intermittent pressure to act upon the dash-pot at each revolution and it would not produce the effect nor control the governor as it would with a fly-wheel of the proper weight.

x-Q. 85. But the engine I am inquiring of is to have enough metal in the other wheel to give the proper weight in the balance wheel. What I want to get at is this—would the dash-pot perform any other or different functions when in a governor which is in a fly-wheel, than it does when it is in a governor which is in a band wheel, the engine being provided at some other point on the shaft with the proper amount of balance wheel. You are to understand that the band wheel and the fly-wheel have the same diameter. You are to further understand that the weights and springs and eccentric, means of adjusting the springs and the manner of adjusting the springs are all to be the same as are shown in your model?

A. In answer to the first part of the question, I will say if the engine had enough weight in the other wheel to control the engine properly after the governor wheel was turned down, it would have too great a weight of metal to enable the governor to act quickly and properly before the governor wheel was turned down. In answer to the latter part of your question, I never saw one of those governors constructed in that kind of a wheel, and don't know what its operation would be, and could not tell unless I saw the construction. It certainly would be an unnecessary expense and labor to make both wheels when it could all be constructed in one fly-wheel as shown in my invention.

x-Q. 86. Well, then I understand that you are not prepared to swear that the dash-pot would perform any other or different office in one case than that which it performs in the other case. Is that right?

A. That would depend upon the kind of wheel it was in. I certainly am prepared to

swear that it would perform an entirely different duty if in a fly-wheel as shown in my patent than it would perform if placed in any pulley or wheel that I have ever seen in use with the governor."

Here we have the declaration reiterated. The fly-wheel as shown in the patent is the sole fly-wheel of the engine, and he says that if his governor is placed in any other wheel he never saw a governor in it would not be the same in effect. Now the witness has seen hundreds of Ball and Armington & Sims engines with governors in belt pulleys at one end of the shaft and fly-wheels at the other end of the shaft, both wheels the same size, and both serving as belt pulleys and fly-wheels jointly. But let us continue the quotation:

"x-Q. 87. Your patent says, in speaking of the office of the dash-pot, that is to say, the result of its use, beginning on line 41, page 2, by means of the dash-pot applied to the relatively movable parts and stationary parts, or to the unequally moving parts, as described, wide and sudden radial movements of the weights *E* are prevented." Would not the dash-pot when thus applied in one of your governors which was fixed to a band wheel, prevent wide and sudden radial movement of the weights?

A. You have proposed an impossibility. I can only answer your question by saying it would be impossible to attach one of my governors to a band wheel unless that band wheel was also a fly-wheel. It would then contain my invention.

* * * * * *

x-Q. 89. Well, then I will see if I cannot state a question that you will understand. Now supposing we had a wheel on an engine that was exactly the same size as your fly-wheel, except that it had a thinner rim, so that it was a band wheel and not a fly-wheel, and the engine was provided with another wheel, sufficiently large and heavy to perform the functions of the fly-wheel, and in the band was an automatic cut-off governor, with the same weights, same arms, the same springs, the same manner of adjusting the springs and the same dash-pot, arranged the same, all of these parts in every respect like those in your model, then I ask, would not the dash-pot in such a construction prevent wide and sudden radial movement of the weights?

A. Undoubtedly it would have a tendency in that direction."

It would not contain his invention, because the wheel would not be a fly-wheel, but the dash-pot would have a "tendency to prevent wide and sudden movements of the weights."

The complainant's expert, Hoffman, is clear on this point. We quote from his testimony, beginning with x-Q. 58, p. 104, C. R.

"x-Q. 58. I now call your attention to the other patent, 301,720, and ask you to look at the claim. Supposing that claim read up to the first comma, in a wheel governor in place of reading in a fly-wheel governor, would you understand the claim then to have any other or different significance from what it has now?

A. If the claim as laid down should be changed in its phraseology to read as you have just suggested in your question, and the speci-

fication and drawings bore out the test in its changed form, I should certainly say that it could have some other significance, and would of necessity have some other significance than the claim of the Ide patent in suit, as actually incorporated in the specifications No. 301,720.

x-Q. 59. What change in the drawing would be necessary?

A. For example, if it were simply a wheel governor, or we will call it a disk governor, or we will go father and call it a light pulley governor, ——

Counsel interrupts: You have no right to assume anything further than the question, which is confined to a wheel governor.

A. Continuing my answer, I will say that if we were to construct a pulley or wheel governor, for the simple purpose of containing a governor of this description, it would not be in the nature of a fly-wheel, but would be reduced in diameter, in weight and proportions, as each and every portion would be different from that in the combination of the fly-wheel governor and dash-pot."

Defendants have always used two wheels on their engine shafts, one as a belt wheel and the other as a fly-wheel, and the governor has always been placed in the belt wheel.

It will not do for complainants to claim that defendant's pulley wheel performed part of the offices of a fly-wheel, for they have repudiated all wheels as fly-wheels unless they are the sole fly-wheel on the engine. Other wheels which may incidentally perform part of the work of a fly-wheel they say do not contain the Ide

invention even though they have therein a governor with a dash-pot in combination with its relatively movable parts. That which is buzzard in one man's hands can't be turkey in another man's hands, and that which does not anticipate an invention cannot be an infringement of it

Let us now go to the second position: We hold that the defendant's construction is not an infringement of the claim of the patent even though it be given the widest scope possible under the law, without any limitation because of the prior uses shown. The language of the claim is:

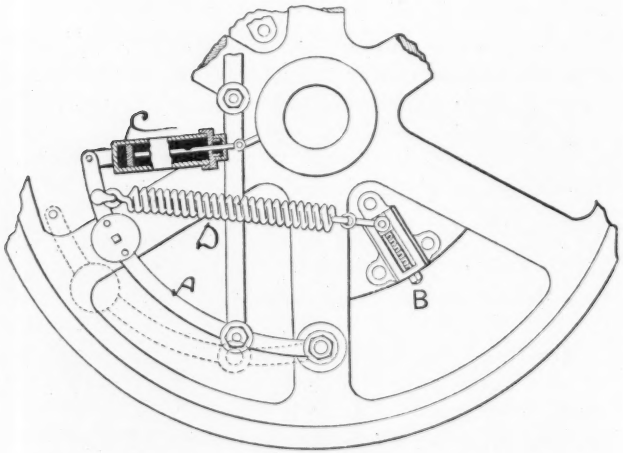
> "In a fly-wheel governor the combination
> "with relatively movable parts, of a dash-pot,
> "substantially as described."

Now the widest possible scope that can be given to that claim cannot include any combination of a dash-pot with the relatively movable parts of any governor for any purpose, even though no other prior use of a dash-pot had been proven.

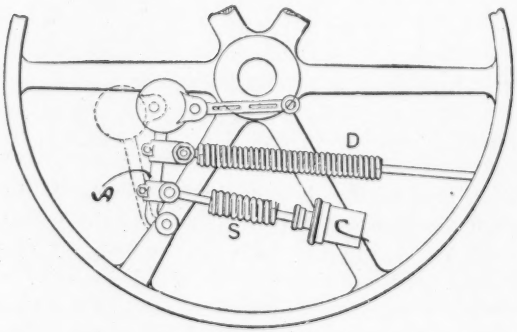
The *rationale* of the invention must be considered, and if in the alleged infringing use the dash-pot performs none of the functions of the dash-pot in the patent, and there is a change of structure and application of the dash-pot by reason of the changed function it performs there will be no infringement.

This proposition is certainly sound. It is elementary, and we need cite no cases to sustain it. For example, suppose that some one should discover that by a peculiar use of a dash-pot in a fly-wheel governor, electricity could be generated, and to effect that result the dash-pot would be applied differently and constructed differently from that in the patent, and in its use it would not perform the office it does in the patent, and also that other mechanical con-

trivances would have to be incorporated. Surely such a use would not be an infringement. Now let us compare the Ide and Ball constructions. For convenience we will insert the cuts of these governors.



IDE GOVERNOR.



BALL GOVERNOR.

In each construction there is a weight arm *A*, a centripetally acting spring *D*, and a dash-pot *C*. In

Ball's construction there is a spring *S*, interposed between the dash-pot *C* and the arm *A*, which is not found in Ide's construction. In Ide's governor there can be no movement of the arm *A* without a simultaneous movement of the dash pot piston within the dash pot, while in Ball's governor, if the piston of the dash-pot has a greater resistance than the spring *S*, which connects it with the arm *A*, the arm may move by stretching or compressing the spring *S*, and not move the piston of the dash-pot.

In the Ide governor, to quote the language of the patent, "the aperture *h*, will be made of such size, according, of course, with the size of the cylinder, springs and weights as to allow all necessary promptness of action on the part of the governors."

The aperture *h* referred to is not seen in the cut but is shown in Fig. 1 of the patent, and is an aperture through the piston of the dash-pot. If this aperture is very small the movement of the piston will be very sluggish, but if it is of sufficient size the piston may have the power of moving quite rapidly. As the piston in the Ide construction must move as the arm moves it is necessary that the aperture have sufficient size to enable the piston to move with sufficient rapidly "to allow all necessary promptness of action on the part of the governor," as stated in the patent. Anything short of this would defeat the purpose of the governor. Now in the Ball construction the springs *S* and *D* alone resist the movement of the weight arm. The dash-pot piston in no way affects the movement of the weight arm. The dash-pot is used only a yielding base for the spring *S*. It is made with a very small aperture in its piston so that it will not yield with promptness at all, but on the contrary it is made so it will not be moved simultaneously with the weight arm, but

will offer so much resistance that the spring *S* will be compressed or expanded, as the case may be, by the action of the weight arm. After the weight arm has found its new position the dash-pot will gradually yield and relieve the spring *S* from the strain.

The object of this construction will be fully understood by reference to the patent to Ball, which will be found beginning on page 210.

There has been a recognition by the complainant of the necessity of showing that the piston of the dash-pot in the Ball governor moves simultaneously with the weight arm.

He has introduced in evidence as an exhibit a dash-pot and springs of his own make which is in appearance like the ones used on the Ball governors, but we have objected to the exhibit as not like our construction, and that it is not we shall fully show to the Court.

Mr. Ide when on the stand was questioned as to this exhibit; his testimony is as follows, page 193, C. R.:

> "RD-Q. 19. Please state what effect, if any, the introduction of this spring into defendant's dash-pot or its incorporation therein in connection with or as a part of the piston-rod, has in the practical operation of defendant's dash-pot, as one of the elements of defendant's fly-wheel governor mechanism and give your reasons for your statements or conclusions enforcing the same by any tests you have made in confirmation of any facts you state?
>
> A. The only possible effect the spring could have is to increase the friction of the piston-rod and piston in its movements, on account of the great weight of the spring under the centrifugal

force when the engine is in motion. This would have a tendency to prevent the quick and free action of the dash pot. It does not and cannot perform any other function, or make any change in the operation of the dash-pot or the governor to which it is attached for the reason, it is so rigid and unyielding that it would not act to any perceptible or appreciable extent under any pressure that could possibly be brought to bear upon it in the action of the governor under wide and sudden changes of load and varying steam pressures. The reason I am positive the spring cannot act and does not act as a spring, is because a pressure of four or five pounds will cause the dash-pot to act freely, causing the glycerine with which it is filled to pass through the hole in the piston from one end to another. This assertion can be readily tested by a hand movement on the exhibit itself. Now any mechanical engineer can readily ascertain by well known rules or tables in standard works the amount of pressure or force that would be brought to bear on this piston-rod under a sudden vibration of any number of revolutions or change in the speed of the engine, and they will find that even under an instantaneous change of ten revolutions of the engine, which would be entirely inadmissible in practice, that the pressure on the spring, even if the dash-pot did not act at all, would not exceed twenty-five pounds, but it would be an utter impossibility to maintain a pressure of twenty-five pounds on the piston-rod for one second without causing the piston to move and prevent the action of the springs, so that under no circumstances could a pressure of twenty-five pounds be exerted on the spring; but even admitting that the dash-pot did not

act at all, the spring would not act or be compressed, consequently it could have no effect on the action of the dash-pot or the movement of the valve of the engine. For the purpose of knowing positively that these statements are absolutely true, I have tested this spring by placing it endwise on the platform of a pair of Fairbanks' standard scales, and applying a screw to the opposite end of the spring until the spring was compressed one-thirty-second of an inch. I then moved out the weight on the scale beam until it balanced and recorded a pressure on the spring of forty-five pounds. I then compressed the spring beyond its initial position one-sixteenth of an inch and moved out the weight on the scale beam until it balanced, registering eighty-four pounds. I then compressed the spring from its initial position one eighth of an inch and when the scale was balanced it registered one hundred and sixty-four pounds. I then compressed the spring from its initial position one-fourth of an inch, put on additional weights on the scale beam until it balanced and registered 329 pounds. Mr. Pearson, one of the witnesses in this case, also tested one of the springs on the dash-pot of one of those Ball engines at the Lake View Electric Light Company, Chicago, which test corresponded very nearly with the test I have given, and that spring corresponded in size exactly with the spring of this exhibit. This test clearly shows that it requires eighty-four pounds to compress this spring one-sixteenth of an inch, which is the least amount that would give any perceptible effect on the movement of travel of an engine valve. Besides it is clearly evident to any person that it would be impossible to put or maintain a force of eighty-four pounds on

this spring for an instant, on account of the piston moving freely in the centre under a pressure of five pounds. As briefly stated, in my opinion the spring is a serious objection on account of its great weight which has increased several times its normal weight under the action of centrifugal force, thus crowding or springing the rod out of line and causing the piston-rod and connections to bind on their bearings.

RD-Q. 20. What effect would it have if the spring as shown in the exhibit and in defendant's governor were made of sufficient weakness and resiliency to respond to the movements of the levers and weight mechanism, before any movement of the dash-pot?

A. It would have the effect of defeating the objects sought to be obtained by the use of the dash-pot, and set up a vibration and jumping and pounding of the governor weights. In order for this spring to operate or have any appreciable effect as a spring, it would have to be weak enough to compress or yield to the extent of one-eighth of an inch under a pressure of from five to ten pounds, and that would be very many times weaker than the spring in the exhibit.

RD-Q. 21. I call your attention to a careful consideration of the patent of one of the defendants, Mr. Ball here, and ask, after perusal of said patent, if your conclusion or statement as to any opinion or fact is changed by any matter or thing appearing in said patent?

A. I have read and examined the Ball patent, Number 358,829, and think I understand it fully, and the objects thereby sought to be obtained, but the facts stated by me show the theory to be delusive. The only merit evidently of the Ball patent lies in its containing the

elements of my invention covered by my claim, and that the interposition of the alleged spring is merely a subterfuge to escape my patent.

RECROSS-EXAMINATION by J. K. Hallock, Esq.:

Re-x-Q. 1. Please look at your model, "Complainant's Exhibit Complainant's Governor," and give me the size and dimensions of the dash-pot complete on an engine of the same dimensions as the Ball engine you have named as being at the Lake View Electric Light Company?

A. I don't build an engine of the same dimensions and proportions as the Ball Engine Company, but one of my engines equal in power to that size would be twelve inches diameter cylinder by eighteen-inch stroke, rated at eighty horse power. The dash-pot in that size engine is about two inches in diameter inside of the cylinder and about nine inches long including the stuffing box, and the piston has a travel of four or five inches, the piston rod being seven-sixteenths of an inch in diameter, and the piston head about one inch thick.

Re-x-Q. 2. Does the piston in your dash-pot fit so closely as to preclude the passage of fluid between it and the cylinder as it moves in the cylinder?

A. It is made to fit as close as possible without causing friction. Probably a little glycerine passes between the piston head and the cylinder as there is no packing used.

Re-x-Q. 3. What is the total area of vent opening in your piston?

A. I never figured the exact area. We usually put in one hole size, three-sixteenths of an inch in diameter. Where very quick action of

the governor is required in throwing on and off the engine heavy loads, we put two holes through the piston head, each three-sixteenths of an inch in diameter, and sometimes vary the size of the holes a little for special requirements.

Re-x-Q. 4. The degree of resistance offered by the dash-pot depends, does it not, first, upon the sizes of the piston as to diameter; second, as to area of vent opening, and third, as to how close a fit the piston is within the cylinder?

A. It does, entirely so.

Re-x-Q. 5. How much resistance will a dash-pot offer, which has a piston which fits absolutely tight, that is, so it won't leak, which is two inches in diameter and has a vent opening one-sixteenth of an inch in diameter?

A. The amount of resistance will depend entirely on the consistency of the glycerine and the rate of speed or rapidity at which power is applied. If the power was applied slowly, the resistance would be light. If it was applied quickly or rapidly the resistance would be great.

Re-x-Q. 6. Well, let us get at it in this way. We have a dash-pot with a piston two inches in diameter, and it is supposed to fit so as not to leak, and it has a vent opening one-sixteenth of an inch in diameter, and the glycerine is of the same consistency as that you use. How many pounds of force will it take to move that piston a half an inch in one-fifth of a second?

A. I don't know and can't approximate it, but it would burst the cylinder if sufficient force were applied to move it that distance in the length of time named. It would require a power of several hundred pounds or perhaps several thousand pounds, but the force applied to the dash-pot through the action of the weights in both the Ball engine and my engine is never

sudden, but is applied gradually. It would be impossible to bring a sudden force upon the spring or dash-pot, such as is referred to in the question, because it requires a great change in the speed of the fly-wheels, and on account of their great weight and high velocity, this change cannot occur suddenly even under the most extreme changes of load possible on account of the great inertia stored in the revolving fly wheels."

Now it is admitted by this testimony of the complainant himself that if the spring *S*, in the cut of the Ball governor, here printed, or the spring *E* in the drawing of the Ball patent, was of sufficient weakness to respond to the movements of the levers and weight mechanism it would defeat the objects sought to be obtained by the use of the dash-pot, as in complainant's construction; for it would "set up a vibration and jumping or pounding of the governor weights." There is no doubt about this; if the spring *S* of the cuts, or the spring *E* of the Ball patent was applied to the Ide construction as a connection between the dash-pot and the weight arms it would defeat the objects sought to be obtained by Ide's use of a dash-pot.

Defendant's witness Tabor makes the same statement in effect in his answer to Q. 30, page 21, D. R., as follows:

"If the spring *E* shown in Ball's patent were to be used in combination with the dash-pot in the Ide patent, it would, in my judgment, yield in response to the inertia of the valve, to a certain extent, and probably give instability to the weights, if the springs in the Ide governor were drawn up to a theoretical intitial tension. In

this case the spring would destroy to a certain extent the rigidity given to the dash-pot."

It is a fact that the Ball dash-pot and spring could not be applied to the Ide governor in place of the dash-pot he employs and accomplish the purposes sought to be obtained by Ide, as stated in his specification. The specification of the Ide patent in the declaration of invention, on line 14, page 1 thereof, says the invention "has for its primary object to provide means for holding the ecccentric steadily in its proper poised position * * * as sought to be determined by the balanced forces of weights and springs when the engine is in motion."

In other words, the object of the invention is to lock the eccentric against being thrust from its proper poised position.

Now, if the Court will please look at Fig. 1 of the Ide Patent No. 301,720 we will endeavor to explain the mechanism and the result of the application of the dash-pot.

C indicates the eccentric, which has an elongated shaft opening so that the eccentric can move across the shaft diametrically. *D* is a support for the eccentric *C*, and it is pivoted at *d* so the eccentric can swing across the shaft diametrically. C^1 is a lug extending from the eccentric and connects with a horizontal bar *G* by a pivot pin *g*. By giving the bar *G* a horizontal movement diametrically across the wheel *A* it will impart to the eccentric a like movement. The bar *G* is connected with the weight arms in such a way that, as the weights move radially, the bar *G* will move diametrically. *R* is a valve rod —that is, the rod that takes hold of the valve of the engine and moves it reciprocally. Now, it will be seen that the position of the eccentric as to the centre of the shaft *B* is determined by the position radially of the weights *E*, and the position of the weights is, of course, dependent on the speed of the wheel,

and the stability of the eccentric in its poised position is acquired from the centrifugal force exerted by the rotation of the wheel. In starting up or slowing down the engine this force is not sufficient to give the eccentric enough stability to withstand the inertia and friction of the parts reciprocated by the rod *R*, and hence the eccentric will be thrust out of its poised position and the weight will be suddenly moved radially.

To prevent this the dash-pot *H* is applied between the end of the arm *E* and the hub of the wheel. Now if the stem H^1 of the dash-pot piston was to have a spring incorporated in it so as to permit it to elastically elongate or contract under strain it is perfectly evident that it would defeat the purpose of the application of the dash-pot, for the eccentric would not be held against thrust from its poised position and the weights would be made to "jump" or "vibrate."

Now, by referring to the model of defendants' governor it will be seen that the eccentric which moves the valve-rod is moved by a second eccentric which has no movement across the shaft, and hence it cannot be thrust by the resistance of the valve-rod, and therefore there cannot be imparted to the weights a "jumping" or "vibrating" action by the action of the extraneous forces named in the Ide patent, and therefore there would be no object in applying a dash-pot for that purpose.

We have, therefore, shown:

1. That if the Ball dash-pot and spring was applied to the Ide governor it would not effect the objects of the application of the dash-pot as and for the purposes named in the Ide patent.

2. That the use of the dash-pot in the Ball governor, as shown and described in the Ide patent, would be superfluous.

3. That the dash-pot is used in the Ball governor in a different manner and for a different purpose from that named in the Ide patent, and that its use by Ball for his purpose necessitated the incorporation of a further mechanical element, to wit, the spring *S* of the cut, or *E* of the Ball patent, which element the complainant, Ide, swears would defeat the purpose of his invention if incorporated in his construction.

Hence the Ball governor is not an infringement of the Ide patent.

J. K. HALLOCK,
For Appellee Ball.

J. D. GALLAGHER,
Of Counsel.

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JAMES H. McKENNEY,
CLERK.

IN THE

Supreme Court of the United States.

October Term, 1892. Term No. 227.
Case No. 13,836.

ALBERT L. IDE, Appellant,
Complainant below,
vs.
THE BALL ENGINE COMPANY, F. H. BALL, JAMES McBRIER AND P. S. KINGSLAND, Appellees,
Defendants below.

APPEAL from the Circuit Court of the United States for the Northern District of Illinois.

BRIEF FOR APPELLEES.

J. C. STURGEON,
For Appellees.

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which a decree was on the same day entered (printed in the Record pg. 13), dismissing the complainant's bill for want of equity, at complainant's costs, and execution issued therefor.

Appeal from this decree was duly taken to this Court.

BRIEF FOR APPELLEES.

THE PATENT IN SUIT.

The patent No. 30,172 (printed at pg. 152-154 of Record), was issued to A. L. Ide for a steam engine governor on July 8, 1884, on his application filed in the U. S. Patent Office therefor, July 11, 1883.

No attempt is made by complainant to establish a date for his invention earlier than the date of the filing of his application for patent, July 11, 1883, hence if the defendant's references are pertinent, their dates so far anticipate the date of complainant's invention as to defeat the patent sued upon.

The single claim of the patent is as follows:

> "*In a fly-wheel governor, the combination, with relatively movable parts, of a dash-pot, substantially as described.*"

The concluding phrase of the claim "*substantially as described*" qualifies or limits the claim as a whole and not any particular part thereof.

In the specification of said patent upon which said claim is based, the patentee says: (see pg. 152 of Rec.)

> "This invention relates to that class of steam engine governors known as "fly-wheel governors," and has for its primary object to provide means for holding the eccentric steadily in its proper poised position, in opposition to the tendency of certain extraneous forces which are calculated to disturb the movements of the valve as sought to be determined by the balanced forces of weights and springs when the engine is in motion."

He then proceeds to define his supposed invention as follows, viz: (pg. 152 of Rec.)

> "To this end the invention consists in the combination of a dash-pot with the governor and *pulley*, said dash-pot connected with a fixed and movable part, or with two relatively or unequally movable parts, as for example, with the extremity of a weight lever and the pulley-hub."

He then proceeds in his specification to describe the class of governors to which he said his invention related. (pg. 152 of Rec.)

> "In this class of governors the position of the eccentric is variably determined by the opposing and self-balancing forces exerted by the centripetally-acting spring or springs, and the centrifugally-acting weight or weights connected with said springs, the intention being to hold the eccentric permanently in a certain poised position for a given speed of the wheel to which the governor is applied, and to vary the position of the eccentric exactly as the speed of said wheel is varied."

That the type of governor thus described was old and well known and in common use at and prior to the date of the application for said patent, is tacitly admitted by the patentee in the above quoted clause of the specification, but that there may be no doubt as to that, we will refer to the testimony of Hoffman, complainant's expert. (pg 47 of Rec.) and of Ball (pg. 201 of Rec.)

Now in relation to this old and well known class of steam engine governors, the patentee in his specification further says: (pp. 152 and 153 of Rec.)

> "There are, however, certain temporarily-acting causes of disturbance calculated to change the position of the eccentric independently of the speed of the wheel. The principal of these disturbing causes is the inertia of the reciprocating parts, including the eccentric and the parts actuated there-

> by; and a secondary cause is the gravity of the eccentric when not counter-balanced by some special device for the purpose."

And to correct these alleged defects, he inserts a dash-pot which was long prior to his alleged invention an old and well known device, both in its construction and operation, as the patentee himself says near the close of his specification, (pg. 154 of Rec.) viz.:

> "By the term "dash-pot" in the appended claim I mean the device technically known by that name—usually comprising a closed cylinder, a piston having a passage through or around it, and a fluid confined in the cylinder as shown—or its equivalent."

Dash-pots have been used for various purposes for many years prior to the date of said alleged invention in combination with springs for restraining the too sudden operation thereof. A familiar example of such use being the combination of dash-pots with springs for automatically closing doors, the function of the dash-pot being to prevent the spring from slaming the door shut suddenly, the dash-pot restraining the too sudden action of the spring mechanism so that the door closes gradually.

FLY-WHEEL GOVERORS.

It will be observed that the phrase "In a fly-wheel" governor is used in the claim of the patent, and it is upon this phrase alone that the complainant seeks to hang his entire case in this suit, as if he cannot sustain that phrase *as an important and controlling element of his claim*, his case in view of the anticipating devices clearly proven by the defendant, and hereinafter refered to in the second branch of the defense, must inevitably fail.

In view of this fact, what is a "*fly-wheel governor?*" Ball, one of defendant's witnesses, says the type of governor shown in complainant's patent is a "shaft-governor" (pp. 201 and 202 of Rec.) and Thompson, defendants' expert says: (pp. 172 of Rec.)

> "By a shaft governor, I understand is meant a governor placed on the main shaft of the engine, or adapted to be so placed. If it serves also as a fly-wheel, it becomes then a fly-wheel governor, but it is also still a shaft-governor for the reasons before stated," *et. seq.*

See also Gardiner Simms testimony on this point (*pp.* 207 *and* 208 *of Rec.*)

From the above referred to evidence it is obvious that the terms or phrases "fly-wheel governor," "shaft-governor," "wheel-governor," and "shifting-eccentric governor," are all substantially synonymous terms or phrases, in steam engineering, and are used indiscriminately by steam engineers in refering to governing mechanism operating on the main shaft of the engine. This matter however will be more fully considered under the second part of the defense set up by the defendants in this case.

THE DASH-POT.

As has been before stated dash-pots were admittedly old at the date of complainant's alleged invention. In brief, the complainant says in substance that the construction and method of applying a dash-pot so "as to prevent sudden movement of the weight levers or of the eccentric," consisted, *first*, in applying "a dash-pot connected with a fixed and a movable part, or with two relatively or unequally movable parts" of the governor, and, *second*, in making the apperture in the piston of the dash-pot of such "size (according, of course, with the size of the cylinder. springs and weights) as to allow all necessary promptness of action on the part of the governor." This is exactly as a dash-pot had always been used prior thereto. It had always been combined in use either with relatively and unequally movable parts, or with a fixed and a movable part, and when so used the speed of its action had been regulated by the proportion of the hole in the piston head, to the size of the cylinder in which it moves, and to the strength of the springs, or the weight of the load, the movement of which

the dash-pot was designed to retard. And this feature of adjustment can only be determined by experiment and adjustment, a fact substantially admitted by the patentee in his specifications.

Again the use of a dash-pot was no novelty in steam engine governors for years prior to the patentee's alleged invention. William H. Hoffman, complainant's expert witness, testified. (See X. Q's, and A's, 29 and 30 on pp. 49 and 50 of Rec.)

> "X. Q. 29. Then, as I understand it the Hartford Engineering Company and you, as a superintendent, had learned and understood the art of preventing a governor from racing where it is subjected to undue extraneous influences, such as undue friction and inertia and the effects of gravity, before 1884, by the application of a dash-pot to the relatively movable parts of the governor?
>
> A. I cannot say how much the Hartford Engineering Company, as a company, were instructed by the application of the dash-pots to the governors of the Hartford Carpet Company, and the Hartford Manilla Company, but I know that I was personally aware of there having been oil dash-pots applied to the fly-ball governors of the engines built by Woodruff & Beach, Geo. H. Corliss, Thurston & Gardner, and other eastern builders twenty years before these were applied to the engines at the Hartford Carpet Co. and the Hartford Manilla Co., and when the air was excluded from the dash-pots built by Woodruff & Beach, thus preventing elasticity of movement in the dash-pot, there was no trouble in getting nearly perfect regulations.
>
> X. Q. 30. Then you at least, prior to 1884, understood the art of which I inquired in the previous question?
>
> A. I did so for as it applied to the pendulum or fly-ball governor, as attached to automatic cut off engines."

The use and function of dash-pots in fly-ball governors then must be taken as admitted; and while the features of the construction of fly-ball governors and fly-wheel or shaft governors differ, yet the purpose of both is substantially the same; viz.: to so regulate the supply of steam to the engine as to produce greater or less isochronism, or uniformity in the spend of the engine operating under varying loads, both of these types of governors operate cut off mechanism which increases or diminishes the amount of steam admitted to the cylinder, and in both types centrifugal weights mounted upon pivoted arms are commonly employed. In the fly-ball type these arms and weights are moved inwardly by gravity and outwardly by centifugal force, and in the fly-wheel or shaft governor, the arms and weights are moved inwardly by centripetally acting springs, and outwardly by centrifugal force. In both of these types of governors the dash-pot acts upon similar movable parts; the relatively or unequally movable parts in both types being the same, *so far as any possible use or function of a dash-pot combined therewith is concerned.*

Nor is there any new or patentable feature in the so called *relatively movable parts themselves*, they are describe at length in the specification of the patent, and consist substantially in a pivoted weighted lever, adapted to be moved outwardly by centrifugal force, and inwardly by spring extending from some point on the pully to said arm, and acting centipetally thereon, and a link connecting said lever to a movable eccentric which controls the steam valve of the engine. This brief description of the principal features of a fly-wheel or shaft governor, applies equally well to the fly-wheel or shaft governors made and used long prior to complainant's alleged invention. Each of which contained as an essential part thereof *such relatively or unequally movable parts, connected with a movable eccentric.* James Whitelaw, in "Reportory of Patent Inventions for 1826," was credited with having invented the combination of a governor with the valve gear of engines. (Knights, Dic. 999.) And the specification of

this patent says "that the alleged invention" relates to *that class* of governors known as fly-wheel governors.

Now it has been clearly shown that dash-pots have long been used between the *relatively or unequally movable parts* of fly-ball governor, to correct imperfections in the operation thereof. It is also clearly shown that the operative parts of fly-wheel or shaft-governors, likewise consist of *relatively or unequally movable parts.* Is there anything patentable in taking the dash-pot from between the relatively or unequally movable parts of the fly-ball governor and putting it between the relatively or unequally movable parts of a fly-wheel or shaft-governor?

We have heretofore shown that the function and result of the use of the dash-pot in both cases is precisely the same.

Nor is there any novelty claimed in the manner of attaching the dash-pot to the relatively or unequally movable parts of the governor.

The specification says: (see pg. 1 4 of the Rec.)

> "The dash-pot, while preferably connected with the end of the lever E, may obviously be attached to the eccentric itself and to a fixed or less movable part of the apparatus," thus necessarily implying that the point or points of connection between the dash-pot and the other parts of the governor is purely optional with the constructor.

A great deal of learned and interesting, but utterly useless discussion is indulged in by the complainant's experts, some of which, by making unwarranted distinctions between the terms "fly-wheel governor" and "shaft-governor" by the pedantic use of such terms as "equalibrity," and by poor explanations of the term "initial theoretical tension," tend rather to confuse than to instruct. Much is said as to the proper relation or adjustment of the weights and the springs to each other, *i. e.*, of first adjustment and the subsequent re-action of the centrifugal and the centripetal forces, and the resulting effect thereof upon the eccentric on the shaft, which eccentric controls the steam supply of the

engine. All of this, from first to last, has nothing whatever to do with this patent and the claim thereof, which is *upon its face* for a combination of old and well known elements, each operating just as before, one of the elements, (the dash-pot) being added, but when added, performing the same function which it performed in each of the multitudinous combinations in which it had been previously used for many years, and no other function, and performing that function in precisely the same way as previously and in no other. If Court or counsel, however, are not skilled in this art, then these elements and the proper terminology for them must be explained that they may understand the patent as those mechanics and artisans to whom it is primarily addressed, understand it. The following may aid to such an understanding.

In engines designed to operate weaving machines, electric lights and other devices, the revolutions, vibrations or oscillations must be isochronous or isochronal (*isos*) equal (*kronos*) time. If the travel of the shuttle across the weaving machine is not isochronal, the machine is disordered and the work spoiled. The beating of the engine or the revolution of its shaft, on which is the belted wheel, must be therefore, isochronal. This belted wheel and the shaft are revolved by a crank connected with the piston of the steam cylinder, into which the admission and exhaust of steam is regulated by the cut-off and valve gear. Upon the shaft which carries the belt is a fly-wheel having a thick or heavy rim to produce steadiness of motion. But the boiler pressure may increase or diminish, a belt may fly off, some of the lights or looms may be shut off or stopped, etc. In other words, frequent variations occur in the power (steam pressure) and in the load (the work being done). If a belt should fly off, or for any cause, either temporary or permanent, the engine would "run away," and disastrous results follow. For these variations governors are used to make automatically, the desired corrections. Upon the same shaft, upon and by which the belt-wheel and fly-wheel revolve, is put an eccentric which corresponds in movement

with, and in fact controls the motion to and fro of the valve gear and valve which controls the admission and exhaust of steam to and from the front and back part of the cylinder, before and behind the piston as it travels in the cylinder.

A shaft governor consists of centrifugally acting weights opposed by centripetally acting springs, both, with the eccentric, revolving with the crank or main shaft. The centrifugal force of the weights increases in direct ratio to the distance of the balls from the centre of the shaft and to the square of the speed. The mechanical and mathematical rules which govern and measure the increased or decreased force of the centripetal springs, as they are stretched or compressed, are equally well known. Now, if the centripetal springs and the centrifugal weights are so constructed and harnessed together, as that (both in the first instance, as well as in operation, in which the speed of the engine is either decreased or increased), these opposing forces shall just equal each other at all positions, of the balls for any predetermined speed, then we have what is called "full theoretical (initial) tension." But in that case we will suppose that the governor was set and started so as to produce through the valve gear and cut-off, 100 revolutions per minute and a disturbance occurs which increases the speed. The balls fly out, the centrifugal force increases, and, because the centripetal force of the springs increases in exactly the same ratio, the balls are not stopped till the extreme limit of their outward motion is reached. They then stop. The cut-off has been meantime changed through the eccentric, the speed is diminished and the balls travel back toward the center. But as before, for the reason, among others, that at all points of travel the two opposing forces of the weights and springs are at all times equal, the balls will not stop till they have reached the extreme limit of their inward travel; and so they will bob from one limit to the other and prevent, rather than produce, isochronism in the working of the engine. This action of the balls or governor is called "hunting."

Long before complainant's alleged invention, it was demonstrated that the springs should be adjusted at less than "full theoretical (initial) tension," and so constructed and adjusted as that the force of the springs shall increase and diminish faster than the force of the weights or balls do.

Now, in everything which I have said, I have simply repeated what, prior to 1883, was a part of the common knowledge of all those skilled in this art, including the fact, *testified to by complainant's witness*, that for more than twenty years dash pots had been used in fly-ball governors, in at least three different types of engines, for the purpose of giving stability of action; and I have not stated a single thing which was new with the Ide patent, except this, that that patent pretends, and therein consists its sole novelty, that Ide was the first to take this well-known dash-pot from the fly-ball governor and put it into this well-known fly-wheel or shaft governor.

Two conclusions necessarily follow from the facts and arguments hereinbefore stated, either of which is in law fatal to the validity of the patent sued upon. The patent being for putting an ordinary well known dash-pot into an ordinary and well known shaft, or (as the patentee calls it) fly-wheel governor, these conclusions, legally stated, are:

First. The claim of this patent is on its face for a *double use* of well known devices, and is therefore, invalid.

Second. Although possibly a commendable order of mechanical skill was involved in the taking this dash-pot out of a well known combination thereof with the relatively moving parts of a fly-ball governor, and putting it into a like combination with the relatively moving parts of a well known wheel or shaft governor, where it operated in the same manner, and produced the same results, as it had before done in the fly-ball governor. Yet it did not involve invention, and the patent, for that reason, is as matter of law invalid.

DOUBLE USE OF THE DASH-POT.

If the dash-pot in this alleged new combination was of

any necessarily new construction, or if it be operated in any new manner, or if it, *per se*, produced any new result in kind rather than in degree, or if it in any new manner contributed to any new result, in kind, because of the combination as a whole, then the question might arise whether such new construction, operation or result imported patentability. But no such question can arise here.

The dash-pot, *per se*, produces no new result in kind. The utmost that can be said of it is that it contributes to an old result in a well known manner. The sum total of the new effect produced by such a new combination of old elements is this: When in combination with the eccentric, in the fly-ball governor, they produced a certain approach to isochronism of the engine. When in the shaft governor the centrifugal weights of the fly-ball governor are combined with centripetal springs instead of with gravity, they produce a still nearer approach to isochronism, and now comes Mr. Ide and carries over from the one governor to the other the dash-pot, and thereby attains a still nearer approach to isochronism. But is that anything more than a "double use" of the dash-pot? Let us test the question.

Let us suppose that prior to Ide the use of the dash-pot in a fly-ball governor was patentable and that, in a patent describing the same. A. claimed "the combination with relatively movable parts of a dash-pot, substantially as described," and that A. sued Ide for infringement by the use of the device shown in the patent here sued upon, and, further to follow the case at bar, we will suppose that the combination of the relatively movable parts which forms the shaft governor of the Ide machine was public property. Then certainly, conceding A.'s title to such a claim (which was the title of the public at the date of the Ide patent), Ide would be held as an infringer for having made a new double use or analogous use of A.'s invention. The common knowledge and the concession of complainant that the fly-ball governor with the dash-pot belonged at the date of the Ide patent to the public instead of to A., only changes the result to this,

that Ide made a mere double or analogous use of that which already belonged to the public.

In Smith vs. Nichols, 21 Wal. 112. Justice Swayne speaking for the Supreme Court, held that:

> "A mere carrying forward or new or more extended application of the original thought, a change only in form, proportions or degree, the substitution of equivalents doing substantially the same thing in the same way by substantially the same means with better results, is not such invention as will sustain a patent. These rules apply alike, whether what preceded was covered by a patent or rested only in public knowledge and use."

> *In Roberts vs. Ryer*, 91 U. S. 150. It was held that: "It is no new invention to use an old machine for a new purpose. The inventor of a machine is entitled to the benefit of all of the uses to which it can be put, no matter whether he had conceived the idea of the use or not."

Within the rule laid down by this Court in *Hollister vs. Benedict Manufacturing Co.* (113 U. S. 59,) there was nothing more than mechanical skill in arriving at the alleged invention, in view of the state or the art.

In the case of *Ansonia Co. vs. The Electrical Supply Co.* 144 U. S. 11. Mr. Justice Brown delivering the opinion of the Court says:

> "In *Pennsylvania Railway vs. Locomotive Truck Co.*, 110 U. S. 490-494, the adoption of a truck for locomotives which allowed a latteral motion was held not to be patentable, in view of the fact that similar trucks had been used for passenger cars. All the prior cases are cited, and many of them reviewed, and the conclusion reached that "*the application of an old process or machine to a similar or analogous subject, with no change in the manner of application and no result substantially distinct in its nature, will not sustain a patent, even if the new form of*

result had not before been contemplated." The principle of this case was expressly approved and adopted in that of *Miller vs. Force*, 116 U. S. 22."

In *Lovell Manufacturing Co. vs. Carey et al.*, decided at this term. Mr. Justice Blatchford delivering the opinion of the Court, after citing the cases last above referred to in addition to many others decided by this court says:

> "The principle deducible from these cases is that, it is not a patentable invention to apply old and well known devices and processes to new uses, in other and analogous art." And at the close of the opinion in said case, he further says: "But we are of the opinion that the same principle set forth in the patent was developed in the manufacture of the wire bells for clocks and of the hair-balance-springs; that there was no patentable invention in applying that principle to the springs mentioned in the specification, and that the case is merely one of a double use."

The application of the principles decided in these cases, to the patent in suit seems to be too obvious to call for further comment. These cases involve the application of the rule of the analogous or double use of machines operating substantially in the same way and producing substantially like results as do the alleged invention in the patent in suit, and the fly-ball governors in use long prior thereto.

THE BUCKEYE ENGINE GOVERNOR.

The defendants have proved that in the years 1880, 1881, and 1882, certain dash-pot devices had been made and put into shaft or wheel governors, on the engines of the Hartford Carpet Co., at Thompsonville, Conn., and of the Hartford Manilla Co., at Burnside, Conn., in 1881. (Tabor's Test. pp. 176 and 178 of Rec. and Steele's testimony pp. 204 of Rec.) On an engine at the Syracuse Iron Works, of Syracuse, N. Y., previous to 1880, and on the engines at Dow's stores, known as the Pacific Elevator Co., at Brooklyn, N.

Y., in December, 1880. (Schneider's testimony pp. 190 and 191 of the Rec.) This evidence has not in anywise been controverted, and no attempt has been made so to do. In fact, complainant's expert, Hoffman testified thereto. (pp. 31 to 33 of Rec.) And the complainant's counsel in his brief before the Court below substantially admitted its correctness.

Some, if not all, of the engines to which these dash-pot shaft or wheel-governors *were then applied, and on which they were still in use at the date of the taking of the defendant's testimony in this case* (as testified to by Schneider, pg. 190 of Rec. and by Steele, pg. 205 of Rec.), were known to the trade as "*Buckeye Engines.*" These governors were all shaft or wheel governors, (see drawing, defendants Ex. A., marked p. 409, between pp. 210 and 211 of the Rec.) which was made January 22, 1881, and which clearly shows the construction of said "Buckeye Governor" (see Thompson's testimony in relation to said drawing, pp. 166-168 of Rec.)

That these governors embodied all of the essential and operative features, and performed each and every function of the governor described and claimed in the patent in suit, cannot be successfully questioned or denied.

Defendants' witness, Tabor, says (pg. 177 of Rec.):

> Q. 22. "Now, please look at the patent in suit and state what you understand from the specification to be the object and purpose of the invention there described and claimed—that is to say, what defects the device was intended to remedy, as stated by the patentee in the specification?"
>
> A. "As I understand the specifications, the object of the dash-pot in the patent in question is to render *nil* and extraneous forces that may tend to give instability to the governor weights."
>
> Q. 23. "How does this object and purpose compare with the object and purpose you had in view when you applied the dash-pots to the engines at the Hartford Carpet Co.'s and at the Hartford Manilla Co.'s works?"

A. "In each case the unsteadiness of the governor gave serious results. This was due to frictional resistance of the governor; frictional and inertia of the valve and its parts, and to the additional friction in the packing in the stuffing box around the valve rod. The whole object in applying the dash-pots was to overcome these defects, and in each case we succeeded. The object was the same as described in the patent specifications in question."

Q. 24. "I show you now defendants' Exhibit B. Please state if you know what it represents?"

A. "It is what is commonly known as a "Buckeye shaft governor," with the addition of a dash-pot applied in one of the various ways used by the Buckeye Engine Co., of Salem, Ohio. In fact, this governor shows the application of a dash-pot substantially as used by the Hartford Engineering Co. on some of their engines."

See defendants' witness, Thompson's, testimony (pg. 169 of Rec.) See also testimony of complainant's expert, Hoffman, (pp. 49-50 and 51 of Rec.) All of these witnesses agree as to the object of the use of a dash-pot, and as to the results obtained from its use as aforesaid on the Buckeye engines.

It is also a self-evident proposition that a "shaft-wheel governor," or as the patentee terms it, a "fly-wheel governor," operates exactly the same, whether it is secured to the fly-wheel of the engine or to any other wheel secured to the engine shaft, as the wheel to which it is secured has no part or function to perform in the operation of the governor, except to serve as a support for the governor mechanism, and this function is fulfilled by any one wheel on the engine shaft, in the same manner and with the same result as by any other wheel thereon.

(*See Sims' evidence, pp. 208 and 209 of Rec.*)

On rebuttal, the complainant attempts to prove that the "Buckeye governor," so made and used, was not the device

claimed in complainant's patent sued upon. This attempt being based upon the words in the claim of complainant's patent, "*In a fly-wheel governor,*" and complainant's expert witnesses attempt to draw subtile distinctions between the terms "fly-wheel," "balance-wheel," "pulley-wheel," "governor-disk," "disk-wheel," etc., the result being that the Record is thereby encumbered with a large amount of matter wholly irrelevent to the questions at issue in the case.

In all steam engines of the type in question there is a main or crank-shaft, upon which is secured wheels, which operate as fly-wheels or balance-wheels; these wheels may be either band-wheels, gear-wheels, or plain balance-wheels. There may be one, two or more such wheels on this shaft, and whether there is one wheel alone, or more, they operate singly or jointly, as the case may be, as fly-wheels or balance wheels, the inertia or momentum of all of which combine to give steadiness to the revolutions of the engine. In many cases, as in self-contained engines, there are two heavy rimmed band-wheels on the shaft, or one band-wheel and one heavy rimmed balance wheel, the effect being in both cases the same. Some or all of these wheels also operate as band or gear wheels to convey power from the engine. These two features being primarily the sole functions of these wheels on the engine shaft.

In automatic cut-off engines—that is to say, engines using shaft, or (so-called) fly-wheel governors—there is also mounted on the main engine shaft a shifting eccentric, which communicates by means of ordinary valve connections with the steam valve of the engine. This shifting eccentric may be secured to the hub of any one of the wheels on said shaft, which is properly located on said shaft for such purpose, or may be mounted on an entirely separate wheel, called a governor-wheel or governor-disk, secured to the shaft for such purpose, and adapted to carry the weights, springs and other mechanism communicating with and actuating said eccentric. In the latter case it is usual to provide such governor-wheel or disk with a rim of suffi-

cient width to catch or stop the governor weights or balls, if any of them should move too far outward from undue centrifugal force exerted thereon, or because of the breakage of their connections.

It is plain, then, that the governor may be attached to the fly or balance-wheel, a belt-wheel, or to an additional governor-wheel or disk secured to the shaft, and that the placing of the governor mechanism in one or the other of these wheels is entirely a matter of option with the designer of the engine.

There are other facts which are beyond controversy. The means of communicating power from the cylinder is the crank shaft, the revolutions, inertia and momentum, o which, in any given engine, are absolutely uniform throughout its entire length. This crank shaft rotates the wheels secured thereon, whether there is one or more as well as the eccentric thereon, atabsolutely the same speed. The means for determining the point of cut-off of the steam, *i. e*, of measuring the power imported to the crank shaft, is the eccentric and governor connected therewith, which depend for their action entirely upon the rotation of the crank shaft.

To say then that the operation of the governor mechanism and of the eccentric depend in any manner or in any degree upon whether they be placed in a fly-wheel, a belt-wheel, or in a separate governor wheel, all of which wheels are secured to and rotate with the crank shaft, is too absurd to merit either comment or argument.

In the complainant's references to "increased diameter of structure," "absolute ridgidity," "location next to the main shaft bearing" and "economy of construction" he has sought to draw distinctions, to which he seeks to give such importance, as will in some measure substantiate his claim of invention, in the location of the governing mechanism and its dash-pot in the "fly-wheel," as distinguished from its location in another wheel on the same shaft.

The absurdity of any such distinctions and of any claim founded thereon is obvious at a glance, but as has hereinbefore been conclusively shown, it was a common practice prior

to the date of Ide's alleged invention for other makers of engines to locate their fly, or band-wheels on the shaft *next to the main shaft bearing*, and to attach the engine governing mechanism thereto, so there is absolutely nothing in *Ide's* claim as to that feature.

Complainant by his utter failure to make any other answer to the defense established by the defendants, of the prior construction and use on the Buckeye engine of a dash-pot governor, than that the *Buckeye dash-pot governo* , was not placed in the *fly-wheel*, but was placed in a *separate governor wheel*, substantially admits all that defendant contends for.

It is of little importance in this case, to attempt to follow, or controvert complainant's testimony as to what the words "fly-wheel" mean, or to quote the testimony of complainant's expert (pg 30 of Rec.) to the effect that a "fly wheel" is not a "fly-wheel" unless its diameter is three times the length of the stroke of the piston, but eliminating the absurdities in complainant's pretended distinctions between the various wheels attached to the crank shaft of the engine, one fact is too plain for argument, viz: *That all that Ide did*, was previously done in the Buckeye engines.

Much has been said about the harnessing up of the parts of the governor to which complainant has applied a dash-pot, and as to the difference between the harnessing up of those parts of the governor in the *Buckeye* engine, and in the device shown in complaint's patent. As to this it is only necessary to reply that there is no claim in complainant's patent having any reference to the manner the parts of the governor shall be harnessed up, hence the discussion of that question has no bearing on the issue in this case.

Does the *Buckeye dash-pot governor*, admittedly made and used long prior to the alleged invention of the patent in suit, anticipate the invention claimed in complainant's patent in suit?

A good test of this question, is, would the *Buckeye dash-pot governor* infringe the claim of the patent in suit if it had been designed and put into operation subse-

quent to the issue of complainant's patent. There seems to us to be no room for argument on this point. The "Buckeye" governor admittedly embodies all of the features and performs all of the functions claimed in the patent in suit except, that it is not located in the fly wheel, but is placed in another wheel on the main shaft at one side of the fly-wheel, which location we have heretofore shown is wholly immaterial, and would in such case be held to be such a clear attempt to evade complainant's rights, that the Court would not for a moment tolerate it.

Complainant's expert witness, Hoffman, in his testimony regarding the prior use of the "Buckeye governors" in this case, substantially though indirectly admits the correctness of defendant's position, and illustrates the self-evident weakness of complainant's contention, (pp. 50 and 51 of Rec.) viz:

> *X. Q.* 32. "When it was placed on the engines in question and operated satisfactorily, it was proved to you and you then was aware that dash-pots could be applied to the wheel governors for for the purpose of remedying the defects named in my question 29?
>
> *A.* I had then found that a dash-pot was useful in correcting the errors of a governor badly designed, like the Buckeye governor, but at that time had no opportunity of knowing how it would act on the other governors.
>
> *X. Q.* 33. If at that time, say right after it was applied to the Manilla Co. engine, and worked so satisfactorily, that the engine was paid for, and the matter was fresh in your mind, let us suppose that you had been called upon as a consulting engineer to remedy racing in the governor of an Armington & Sims engine, which, you have said, had thereon a fly-wheel governor, and you had found that the racing was caused by the undue influence of extraneous forces, such as undue friction of reciprocating parts and inertia and gravity, or either of

them, would you not have advised the application of the dash-pot to the relatively movable parts of the governor?

A. If I had been called to examine an engine of the build named in the question, and I had found that inherent in its design and construction, that it contained the elements of continuous disturbance to its governing mechanism, I should have at first endeavored to remedy the evil by a change of the parts or position of the principal parts of the governing mechanism, and if I had not accomplished the desired object, knowing what had been done with the dash-pot in the two cases cited in the question, I should have probably made the application of a dash-pot to this fly-wheel governor and should have considered in its application and combination to and with a fly-wheel governor, that I had invented and improvement and applied for Letters Patent on a fly-wheel governor which patent would consist of a fly-wheel in combination with the governing mechanism with a dash-pot attached."

The complainant's expert thus admits that from the prior uses of a dash-pot, in shaft governors, (as he had before admitted its use in fly-ball governors) within his knowledge prior to the complainant's alleged invention, for the correction of irregularities induced by certain extraneous forces, he would have applied a dash-pot in the same manner to a fly-wheel governor, as it had before been applied to the "Buckeye" shaft, or wheel governors to correct the same irregularities induced by the same causes, that had before that time been corrected by the application of dash-pots, to shaft or wheel governors, and he then says *he thinks* he would have made a patentable invention which would consist in the combination of a dash-pot with a governing mechanism in a fly-wheel, the utter fallacy of this latter statement is so absurd as to be unworthy of notice, were it not

from the fact that upon just that and nothing more, complainant rests his whole case.

We believe this case comes clearly within the rule laid down by this court in *Hailes vs. Van Wormer*, 20 *Wall* 353, in which case Mr. Justice Strong, delivering the opinion of the Court, says:

> "All the devices of which the alleged combination is made are confessedly old. No claim is made for any one of them singly, as an independent invention.
>
> It must be conceded that a new combination, if it produces new and useful results, is patentable, though all the constituents of the combination were well known and in common use before the combination was made. But the results must be a product of the combination, and not a mere aggregate of several results, each the complete product of one of the combined elements. Combined results are not necessarily a novel result, nor are they an old result obtained in a new and improved manner. Merely bringing old devices into juxtaposition, and there allowing each to work out its own effect, without the production of something novel, is not invention."

Which rule Mr. Justice Matthews in *Pickering vs. McCullough* 104 *U. S.* 310, in delivering the opinion of the Court, quoted and approved.

This rule has since been followed and affirmed by this Court in the case of *Florsheim vs. Schilling*, 137, *U. S.* 64, and in numerous other cases which might be cited if necessary.

Judge Blodgett, in delivering the opinion of the Circuit Court in this case, has clearly and ably stated the facts of the case, and the conclusion of the court thereon, (pp. 14 and 15 of Rec.) viz:

> "The patentee has but one claim, which is:
>
> "*In a fly-wheel governor, the combination with relatively movable parts of a dash-pot, substantially as described.*"

The proof shows without dispute that as early as 1880 the Buckeye Manufacturing Company of Salem, Ohio, placed upon the driving shaft of their engines governors with weighted arms arranged to swing centrifugally as the shaft revolved, so as to act upon the eccentric, and kept from swinging too readily by centripetal springs, the arrangement and function of the movable and fixed parts of the governor being substantially like the movable and fixed parts of the Ide governor except that it had no dash-pot, the operative parts being held in place upon the shaft of the engine within a comparatively light shell or case with radial arms extending from the shaft. One of these Buckeye engines was placed in what was known as the Pacific elevator or Dow's stores, in Brooklyn, in the State of New York, and, its governor not securing such steadiness of motion in the engine as was desired, a dash-pot was in December, 1880, put into the governor in substantially the manner shown by the Defendant's Exhibit "B" in evidence in this case, the dash-pot in Exhibit B being attached to one of the swinging arms of the governor and to a fixed part, so that its operation was essentially the same as that of the dash-pot in the complainant's patent.

In July, 1881, governors similar in arrangement of parts and with dash-pots were put into the engines of the Hartford Carpet Company, at Thompsonville, Connecticut, and the engine of the Hartford Manilla Company, at Burnside, Connecticut, and these governors with dash-pots attached had continued in use on these engines up to the time the proofs were taken in this case, and all had proved effective in securing steadiness of action in the engines to which they were attached, or, as the witness expressed it, preventing sudden and violent fluctuations of the governor.

The dash-pot attached to these Buckeye governors were connected with a movable and fixed part of the governor in such a manner as to be accurately described by the specifications of complainant's patent. In other words, the structure of these Buckeye governors with the dash-pot added was such as to make them a manifest and palpable infringement of the complainant's patent if they had been made and used after instead of before that patent.

The only feature in which these Buckeye governors with the dash-pot added can be differentiated from the complainant's patent is that they were not placed in the fly-wheel of the engines to which they were attached. Mr. Ide has taken this Brooklyn and Thompsonville governor out of the shell or disk in which it was placed by the agents of the Buckeye Company on the shaft and attached it to the hub and radial arms of the fly-wheel of his engine, and the claim of his patent is for putting this governor with dash-pot into the fly-wheel of the engine.

The most he has done has been to fasten this old Brooklyn and Thompsonville governor to the arms of the fly or balance wheel of his engine instead of leaving it on the driving shaft where he found it, and the only question is, has he invented anything in doing this? I do not learn from the proof that any new function is obtained by the combination covered by this claim; the governor still performs the same function and no other that it did when fastened to the shaft by the shell and arms as in the Brooklyn and Thompsonville governors, and the fly-wheel still performs the functions it did before the governor was brought into it; their joint operation when combined is the sum, and only that of their separate operation in the older machines."

The conclusions arrived at by the Court from facts as stated, (*which facts connot be controverted,*) are undoubtedly correct. Under the law as laid down by this Court in the decisions above refered to. Therefore we believe the following conclusions have been established beyond question:

First. The patent on its face is for a mere double use of a dash-pot, and is therefore invalid and void.

Second. There is nothing patentable in the combination of an old and well known shaft governor, and an equally old and well known dash-pot, with the old and well known fly-wheel of an engine, there being no new functions performed by such combination, which were not performed by the shaft-governor and its dash-pot and by the fly-wheel separately, in the older constructions; this joint operation when combined as claimed in the patent in suit, being the sum only of their separate operations in the older machine, and nothing more.

Third. The record when cleared of its rubbish, shows conclusively, that the combination of a dash-pot with an isochronal governor as used on the "Buckeye engines," is a complete anticipation of complainant's claim in the patent in suit.

It is therefore submitted, that for the reasons stated in the foregoing brief, this appeal should be dismissed, and the decree of the Circuit Court affirmed.

J. C STURGEON,
For Appellees.